
IN MEMORY OF
THOMAS W. STONE
OCTOBER 4, 1877 SEPTEMBER 27, 1933

AMERICAN GAS ASSOCIATION

FIFTH ANNUAL CONVENTION

OCTOBER FIFTEENTH TO NINETEENTH,
NINETEEN HUNDRED TWENTY-THREE,
STEEL PIER, ATLANTIC CITY, N. J.

PROCEEDINGS

For statements and opinions contained in papers and discussions appearing herein, the Association does not hold itself responsible

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REPRESENTATIVES ON UNITED STATES NATIONAL COMMITTEE OF THE INTERNATIONAL COMMISSION ON ILLUMINATION

E. H. Earnshaw...............Newark, N. J.
Howard Lyon..............Gloucester, N. J.
Geo. G. Ramsdell..........New York, N. Y.

SECTIONAL COMMITTEE OF THE NATIONAL GAS SAFETY CODE

W. R. Addicks, *Chairman*, New York, N. Y.

E. H. Earnshaw..............Newark, N. J.
R. G. Griswold............New York, N. Y.
A. H. Hall..............New York, N. Y.
Wm. J. Serrill..............Philadelphia, Pa.

STANDARDIZATION OF GAS APPLIANCE SPECIFICATIONS

W. T. Rasch, *Chairman*, New York, N. Y.

G. E. Bennitt..............New York, N. Y.
W. W. Cummings............Boston, Mass.
J. E. Davies....................Chicago, Ill.
B. B. Kahn...................Hamilton, Ohio
G. M. Karshner............New York, N. Y.
Thomson King..............Pittsburgh, Pa.
H. W. O'Dowd............Jersey City, N. J.
A. L. Palmer..............New York, N. Y.
Geo. D. Roper................Rockford, Ill.
N. T. Sellman............New York, N. Y.
W. H. Tappan..............Mansfield, Ohio
L. B. Wilson, Jr...............Baltimore, Md.
C. C. Winterstein..........Philadelphia, Pa.
P. B. Wiske.................Brooklyn, N. Y.
L. B. Young..................Detroit, Mich.

STATE MEMBERSHIP

Alabama

J. S. Sutherland, *Chairman*, Birmingham

J. M. Barry...................Montgomery
Charles A. Lass.................Birmingham

Arizona

Frank E. Russell, *Chairman*, Tucson

R. G. Arthur.......................Douglas

California

A. B. MACBETH, *Chairman,* Los Angeles

C. B. Babcock.................San Francisco
S. Waldo Coleman............San Francisco
C. O. G. Miller................San Francisco
F. S. Wade.....................Los Angeles

Colorado

GEO. WEHRLE, *Chairman,* Denver

J. M. Daily..........................Pueblo
Paul E. Darrow.......................Greeley
W. S. Townsend..................Trinidad

Connecticut

V. E. BIRD, *Chairman,* New London

C. A. Learned.....................Meriden
J. A. Norcross..................New Haven

Delaware

H. S. SCHUTT, *Chairman,* Wilmington

Florida

ROSCO NETTLES, *Chairman,* Tampa

H. C. Gross.......................Pensacola
R. A. Ziegler....................Jacksonville

Georgia

F. L. MARSHALL, *Chairman,* Augusta

J. H. Hagerty.....................Valdosta
R. M. Harding....................Columbus

Illinois

B. J. MULLANEY, *Chairman,* Chicago

R. B. MacDonald.....................Moline
A. D. Mackie.....................Springfield
R. V. Prather....................Springfield
W. M. Willett.......................Aurora

Indiana

S. E. MULHOLLAND, *Chairman,* Fort Wayne

J. H. Maxon.........................Muncie
C. D. Shaul...................Terre Haute
I. C. Shepard.....................Evansville
F. B. Tracy..........................Muncie

Iowa

H. B. MAYNARD, *Chairman,* Waterloo

C. M. Benedict.................Des Moines
A. L. English.................Council Bluffs
R. K. Runner..................Charles City

Kansas

W. H. McKENZIE, *Chairman,* Kansas City

Harry Warner.......................Salina
Carl B. Wyckoff...................Emporia

Kentucky

T. B. WILSON, *Chairman,* Louisville

Fred Cloen.........................Paducah
Harry Reid.......................Shelbyville

Louisiana

A. E. MERCHANT, *Chairman,* New Orleans

F. C. Armbruster................Shreveport
A. G. Curtis.....................Shreveport

Maine

BURTON SMART, *Chairman,* Portland

John L. Murray..................Biddeford
W. R. Stevens......................Lewiston

Maryland

C. M. COHN, *Chairman,* Baltimore

Howard Bruce ....Baltimore
C. O. Culver......................Salisbury
R. O. Luqueer............New York, N. Y.
L. I. Pollitt........................Baltimore

Massachusetts

C. E. Paige, *Chairman*, Boston

A. M. Barnes....................Cambridge
H. A. Norton........................Boston
D. D. Barnum.......................Boston
H. Vittinghoff.......................Boston
F. A. Woodhead...................Arlington

Michigan

F. W. Seymour, *Chairman*, Battle Creek

G. R. Chamberlain.............Grand Rapids
Chester Grey.......................Lansing

Minnesota

John P. Crowley, *Chairman*, St. Paul

L. O. Gordon...................Albert Lea
W. H. Martell........................Austin

Mississippi

G. M. Moran......................Vicksburg
D. G. Skinner........................Biloxi

Missouri

C. L. Holman, *Chairman*, St. Louis

E. D. V. Dickey...................Hannibal
H. S. Kilby...................Jefferson City
V. L. Elbert.....................St. Joseph
E. R. Locke..........................Mexico

Montana

R. C. Cardell, *Chairman*, Missoula

A. B. Sibley.........................Helena

Nebraska

A. W. Borden, *Chairman*, Hastings

B. G. Dawson.....................Fairbury

New Hampshire

W. F. Norton, *Chairman*, Nashua

E. Seybolt......................Portsmouth
A. J. Smith.........................Concord
Ralph D. Smith.......................Keene

New Jersey

Jacob B. Jones, *Chairman*, Bridgeton

S. J. Franklin.....................Millville
J. P. Hanlan........................Newark
R. R. Young.......................Newark

New Mexico

Arthur Prager, *Chairman*, Albuquerque

New York

G. I. Vincent, *Chairman*, Syracuse

M. J. Brayton.........................Utica
H. W. Peck....................Schenectady
R. M. Searle.....................Rochester

North Carolina

Noble L. Clay, *Chairman*, Winston-Salem

B. F. Prichard..................Greensboro
J. A. Forney......................Charlotte
A. F. Kersting.......................Raleigh

North Dakota

W. H. Brown, *Chairman*, Grand Forks

M. L. Hibbard........................Fargo

Ohio

Martin Daly, *Chairman*, Cleveland

K. C. Krick......................Columbus
J. A. Sloan........................Napoleon
F. W. Stone......................Ashtabula

Oregon

HILMAR PAPST, *Chairman*, Portland

W. M. Kapus........................Portland

Pennsylvania

P. H. GADSDEN, *Chairman*, Philadelphia

F. P. Duggan....................Lewiston

L. R. Dutton....................Jenkintown

Grier Hersh....................York

W. R. Rhoads....................Sunbury

Rhode Island

R. BUCKMINSTER, *Chairman*, Pawtucket

W. C. Clark....................Westerly

E. L. Milliken....................Woonsocket

South Carolina

L. I. POLLITT, *Chairman*, Baltimore, Md.

W. B. Ellis....................Greenville

South Dakota

H. V. ARMSTRONG, *Chairman*, Sioux Falls

E. J. Sherwood....................Mitchell

Chas. Smith....................Yankton

Texas

K. L. SIMONS, *Chairman*, El Paso

Chas. B. McKinney....................Dallas

P. E. Nicholls....................Galveston

O. K. Shannon....................Fort Worth

R. G. Soper....................Dallas

Vermont

W. H. LAWSON, *Chairman*, Rutland

Geo. L. Blanchard....................Montpelier

D. W. Jardine....................Burlington

Virginia

B. B. FERGUSON, *Chairman*, Portsmouth

Frank B. Lawton....................Newport News

Wm. J. McCorkindale....................Roanoke

Washington

FRED K. LANE, *Chairman*, Seattle

Luther Gaston....................Spokane

Harry B. Sewall....................Bellingham

West Virginia

LEON H. WARE, *Chairman*, Martinsburg

J. C. Nichols....................Bluefield

Wisconsin

H. L. Geisse....................Wausau

B. F. Lyons....................Beloit

John St. John....................Madison

A. H. Sikes....................Stevens Point

Canada

ARTHUR HEWITT, *Chairman*, Toronto, Ont.

P. V. Byrnes....................Hamilton, Ont.

A. A. Dion....................Ottawa, Ont.

John Keillor....................Vancouver, B. C.

J. M. H. Young....................London, Ont.

TIME AND PLACE

(1924 Convention)

S. E. MULHOLLAND, *Chairman*, Fort Wayne, Ind.

J. E. Davies....................Chicago, Ill.

G. M. Karshner....................New York, N. Y.

Bruno Rahn....................Milwaukee, Wis.

F. J. Rutledge....................Philadelphia, Pa.

J. D. Taylor....................Baltimore, Md.

L. J. Willien....................Boston, Mass.

SECTIONAL COMMITTEES ACTIVE DURING 1922-1923

ACCOUNTING SECTION

MANAGING COMMITTEE

J. W. Heins, *Chairman,* Philadelphia, Pa.
W. A. Sauer, *Vice-Chairman,* Chicago, Ill.

J. J. Armstrong, Toronto, Can. (Canadian)
W. S. Barker, Newark, N. J.
W. H. Barton, Newark, N. J.
J. H. Bissell, Boston, Mass.
F. A. Brine, Atlanta, Ga.
W. H. Cassell, Baltimore, Md.
DeWitt Clinton, Worcester, Mass. (N. E. Gas Eng.)
H. C. Davidson, New York, N. Y.
E. C. Deal, Springfield, Mo. (Missouri)
W. A. Doering, Boston, Mass.
J. R. Fenniman, New York, N. Y.
A. C. Goodnow, Jacksonville, Fla. (Southern)
Ewald Haase, Milwaukee, Wis. (Wisconsin)
I. S. Hall, Boston, Mass.
E. W. Hodges, San Francisco, Cal. (Pacific Coast)
F. C. Hoffman, St. Paul, Minn.
F. M. James, Aurora, Ill. (Illinois)
Jos. Jeffrey, Scranton, Pa.
Adam Kurtz, Detroit, Mich. (Michigan)
H. J. LaWall, Philadelphia, Pa.
James Lawrence, New York, N. Y.
B. W. Lynch, Chicago, Ill.
J. B. McCabe, Dallas, Texas (South Central)
W. J. Meyers, New York, N. Y.
W. G. Murfit, Newton, Pa.
F. H. Patterson, Rochester, N. Y.
W. H. Pettes, Newark, N. J. (New Jersey)
Edward Porter, Philadelphia, Pa. (Pennsylvania)
O. F. Potter, Newark, N. J.
F. G. Rastenburg, Indianapolis, Ind.
J. G. Reese, Baltimore, Md.
Wm. Schmidt, Jr., Baltimore, Md.
E. C. Scobell, Rochester, N. Y. (Empire State G. & E.)
J. M. Scott, Wilmington, Del.
R. B. Searing, Sioux City, Ia. (Iowa)
B. P. Shearon, Hammond, Ind. (Indiana)
A. F. Short, Providence, R. I.
A. L. Tossell, Chicago, Ill.
A. A. Wilbur, Brockton, Mass. (Gas Sales of N. E.)
A. C. Winters, Chicago, Ill.

BUDGET

F. H. Patterson, *Chairman,* Rochester, N. Y.

W. S. Barker . . . . Newark, N. J.
B. F. Braheney . . . . Chicago, Ill.
H. C. Davidson . . . . New York, N. Y.
Isaac S. Hall . . . . Boston, Mass.
F. M. James . . . . Aurora, Ill.
Joseph Jeffrey . . . . Scranton, Pa.
Adam Kurtz . . . . Detroit, Mich.
Geo. E. McKana . . . . Chicago, Ill.
R. E. Phillips . . . . Lincoln, Nebr.
Edward Porter . . . . Philadelphia, Pa.
F. G. Rastenburg . . . . Indianapolis, Ind.
B. P. Shearon . . . . Hammond, Ind.
A. A. Wilbur . . . . Brockton, Mass.
A. C. Winters . . . . Chicago, Ill.

CUSTOMERS ACCOUNTING

W. A. Doering, *Chairman,* Boston, Mass.

W. H. Cassell . . . . Baltimore, Md.
Thos. R. Clayton . . . . Providence, R. I.
DeWitt Clinton . . . . Worcester, Mass.
J. R. Fenniman . . . . New York, N. Y.
H. F. Frey . . . . Allentown, Pa.
H. F. Hutcheson . . . . Toronto, Ont., Can.
A. R. Keller . . . . Syracuse, N. Y.
Adam Kurtz . . . . Detroit, Mich.
W. G. Murfit . . . . Newtown, Pa.
Otto Price . . . . Quincy, Mass.
L. E. Sanderson . . . . Rochester, N. Y.
H. G. Schaper . . . . Milwaukee, Wis.
P. D. Warren . . . . Chicago, Ill.
A. A. Wilbur . . . . Brockton, Mass.

SUB-COMMITTEE

Exhibition

P. D. Warren, *Chairman,* Chicago, Ill.

W. H. Cassell . . . . Baltimore, Md.
A. R. Keller . . . . Syracuse, N. Y.
L. E. Sanderson . . . . Rochester, N. Y.

FIXED CAPITAL RECORDS

H. J. LaWall, *Chairman,* Philadelphia, Pa.

F. L. Conrad....................Chicago, Ill.
H. C. Davidson............New York, N. Y.
E. L. Heyser..................Allentown, Pa.
A. C. Klein......................Boston, Mass.
C. L. Nelson..................St. Paul, Minn.
C. A. Schlegel.............Philadelphia, Pa.
E. C. Scobell...............Rochester, N. Y.
L. T. Smith.................Milwaukee, Wis.
A. C. Winters...................Chicago, Ill.
Wm. Wurth.....................Chicago, Ill.

INSURANCE

J. G. Reese, *Chairman,* Baltimore, Md.

Harry Anderson...............Chicago, Ill.
G. H. Bourne............New York, N. Y.
N. H. Daniels................Boston, Mass.
A. J. Metzel...............Philadelphia, Pa.
E. C. Scobell..............Rochester, N. Y.
C. B. Scott......................Chicago, Ill.

NOMINATING

Ewald Haase, *Chairman,* Milwaukee, Wis.

Edward Porter.............Philadelphia, Pa.
Wm. Schmidt, Jr.............Baltimore, Md.

RELATIONS WITH CUSTOMERS

A. L. Tossell, *Chairman,* Chicago, Ill.
DeWitt Clinton, *Vice-Chairman,* Worcester, Mass.

John J. Armstrong.......Toronto, Ont., Can.
R. F. Bonsall.................Baltimore, Md.
A. M. Boyd................Philadelphia, Pa.
J. M. Curtin....................St. Louis, Mo.
John DeMaine............Minneapolis, Minn.
W. A. Doering................Boston, Mass.
J. R. Fenniman............New York, N. Y.
G. M. Hergesheimer........Philadelphia, Pa.
P. W. Herring..................Chicago, Ill.
F. C. Hoffman...............St. Paul, Minn.
Joseph Lucena..............Syracuse, N. Y.
P. C. MacDonald.................Chicago, Ill.
F. H. Patterson.............Rochester, N. Y.
O. F. Potter....................Newark, N. J.
John M. Roberts.................Chicago, Ill.
H. C. Schaper...............Milwaukee, Wis.
J. M. Scott.................Wilmington, Del.
P. M. Scott......................Boston, Mass.
A. F. Short.................Providence, R. I.

SUB-COMMITTEES

Complaints

G. M. Hergesheimer, *Chairman,* Philadelphia, Pa.

R. F. Bonsall.................Baltimore, Md.
DeWitt Clinton.............Worcester, Mass.
P. C. MacDonald................Chicago, Ill.
H. C. Schaper...............Milwaukee, Wis.

Co-ordination of Order-Taking and Order-Executing Departments

O. F. Potter, *Chairman,* Newark, N. J.

R. F. Bonsall.................Baltimore, Md.
A. M. Boyd.................Philadelphia, Pa.
John DeMaine............Minneapolis, Minn.
W. A. Doering.................Boston, Mass.
Joseph Lucena...............Syracuse, N. Y.
F. H. Patterson.............Rochester, N. Y.
J. M. Scott.................Wilmington, Del.

Credit and Collection Policies and Contractual Relations with Customers

J. M. Roberts, *Chairman,* Chicago, Ill.

John J. Armstrong........Toronto, Ont., Can.
DeWitt Clinton.............Worcester, Mass.
J. M. Curtin...................St. Louis, Mo.
John DeMaine............Minneapolis, Minn.
H. C. Schaper...............Milwaukee, Wis.
J. M. Scott.................Wilmington, Del.

Development and Education of Personnel

A. F. Short, *Chairman,* Providence, R. I.

A. M. Boyd................Philadelphia, Pa.
DeWitt Clinton.............Worcester, Mass.
J. R. Fenniman.............New York, N. Y.
G. M. Hergesheimer.........Philadelphia, Pa.
P. W. Herring...................Chicago, Ill.
F. C. Hoffman................St. Paul, Minn.
Joseph Lucena...............Syracuse, N. Y.
P. M. Scott.....................Boston, Mass.

STATE REPRESENTATIVES AND CONTRIBUTIONS TO MONTHLY

James Lawrence, *Chairman,* New York, N. Y.

W. J. Achelpohl....................Peoria, Ill.
H. V. Armstrong...........Sioux Falls, S. D.
J. J. Armstrong..........Toronto, Ont., Can.
Wm. H. Barton...............Portland, Ore.
A. W. Borden.....Hastings, Neb. (and Iowa)
DeWitt Clinton.............Worcester, Mass.
E. W. Hodges............San Francisco, Cal.
Geo. R. Horning........Salt Lake City, Utah
T. H. Jackson...............Philadelphia, Pa.
Perry L. King.............San Antonio, Tex.
C. S. Morse................Portsmouth, Va.
O. F. Potter...................Newark, N. J.
W. R. Putnam......................Boise, Ida.
H. C. Schaper...............Milwaukee, Wis.
E. C. Scobell...............Rochester, N. Y.
B. P. Shearon................Hammond, Ind.
Burton Smart.....................Portland, Me.
J. K. Swanson...................Jackson, Mich.

UNIFORM CLASSIFICATION OF ACCOUNTS

W. J. Meyers, *Chairman,* New York, N. Y.

H. M. Brundage............New York, N. Y.
R. A. Carter...............New York, N. Y.
W. A. Doering.................Boston, Mass.
Ewald Haase................Milwaukee, Wis.
Paul Jones.................New York, N. Y.
James Lawrence............New York, N. Y.
Edward Porter..............Philadelpha, Pa.
A. P. Post..................Philadelphia, Pa.
Geo. W. Ratcliffe..............Pittsburgh, Pa.
W. A. Sauer.......................Chicago, Ill.
Wm. Schmidt, Jr..............Baltimore, Md.
J. M. Scott................Wilmington, Del.
A. F. Short.................Providence, R. I.

COMMERCIAL SECTION

MANAGING COMMITTEE

Wm. Gould, *Chairman,* Boston, Mass.
J. E. Davies, *Vice-Chairman,* Chicago, Ill.

Cyrus Barnes, Boston, Mass.
C. E. Bartlett, Philadelphia, Pa.
E. J. Burke, Indianapolis, Ind. (Indiana)
W. F. Corl, Mexico, Mo. (Missouri)
H. C. Crafts, Pittsfield, Mass. (N. E. Gas Eng.)
J. W. Crankshaw, Allentown, Pa. (Pennsylvania)
H. M. Crawford, San Francisco, Cal. (Pacific Coast)
H. A. Doering, Mt. Vernon, N. Y. (Empire State G. & E.)
R. S. Doull, New York, N. Y.
L. R. Dutton, Jenkintown, Pa.
Philmer Eves, New Haven, Conn.
J. J. Flautt, New Orleans, La. (South Central)
A. J. Goss, Ottumwa, Ia. (Iowa)
J. P. Hanlan, Newark, N. J.
H. E. Humphrey, New York, N. Y.
W. B. Johnson, Toronto, Can. (Canadian)
J. P. Jones, Bridgeton, N. J. (New Jersey)
B. B. Kahn, Hamilton, Ohio.
G. M. Karshner, New York, N. Y.
F. H. Knapp, Pittsburgh, Pa.
J. G. Learned, Chicago, Ill. (Illinois)
H. E. McDonnold, Greenville, S. C. (Southern)
J. P. MacSweeney, Rochester, N. Y.
E. D. Milener, Baltimore, Md.
J. J. Murray, Biddeford, Me.
J. B. Myers, Philadelphia, Pa.
H. H. Newman, Trenton, N. J.
L. I. Pollitt, Baltimore, Md.
J. J. Quinn, Quincy, Mass. (Gas Sales of N. E.)
W. T. Rasch, New York, N. Y.
A. G. Schroeder, Grand Rapids, Mich. (Michigan)
D. R. Smith, Baltimore, Md.
C. N. Stannard, Denver, Colo.
E. J. Stephany, Pittsburgh, Pa.
J. R. Stetser, Gloucester, N. J.
C. R. Phenicie, Green Bay, Wis. (Wisconsin)
J. D. Taylor, Baltimore, Md.

CO-OPERATION WITH ARCHITECTS AND BUILDERS

R. S. Doull, *Chairman,* New York, N. Y.

W. A. Adams...................Chicago, Ill.
Philmer Eves............New Haven, Conn.
Ewald Haase................Milwaukee, Wis.
J. B. Myers.................Philadelphia, Pa.

CO-OPERATION WITH THE PLUMBING AND HEATING DEALER

F. H. Knapp, *Chairman,* Pittsburgh, Pa.

Ernest Allen.....................Lynn, Mass.
J. H. Dill.....................Baltimore, Md.
Arthur Friedman.............Cleveland, Ohio
Robert Koehler.................Newark, N. J.
E. A. Willard..................Portland, Me.
F. A. Woodhead.............Arlington, Mass.

HOME ECONOMICS SERVICE BUREAU

PHILMER EVES, *Chairman*, New Haven, Conn.

J. J. Burns....................St. Louis, Mo.
Miss Luella M. Fisher........Cleveland, Ohio
I. H. Moorehead, Jr............Atlanta, Ga.
Geo. H. Stang...........Coney Island, N. Y.
Miss A. B. Swann.............Newark, N. J.
P. D. Warren....................Chicago, Ill.

INDUSTRIAL GAS

E. J. STEPHANY, *Chairman*, Pittsburgh, Pa.

John B. Allington............Rochester, N. Y.
F. F. Cauley.....................Chicago, Ill.
H. H. Clark.....................Chicago, Ill
H. M. Henry....................Toledo, Ohio
J. P. Leinroth...............Newark, N. J.
Henry O. Loebell..........New York, N. Y.
E. D. Milener................Baltimore, Md.
Robert E. Ramsey..........Philadelphia, Pa.
W. T. Rasch................New York, N. Y.
F. M. Rosenkrans..........New York, N. Y.
A. A. Schuetz...............Milwaukee, Wis.
N. T. Sellman..............New York, N. Y.
H. H. Smith...................Boston, Mass.
H. Vittinghoff..................Boston, Mass.

NOMINATING

DORSEY R. SMITH, *Chairman*, Baltimore, Md.

J. C. D. Clark..................Boston, Mass.
H. S. Schutt................Philadelphia, Pa.

RETAIL PRICING

A. P. POST, *Chairman*, Philadelphia, Pa.

Dana D. Barnum..............Boston, Mass.
Charles A. Munroe.............Chicago, Ill.
H. S. Schutt.................Philadelphia, Pa.
Clare N. Stannard.............Denver, Colo.
P. S. Young...................Newark, N. J.

SALES STIMULATION

J. E. DAVIES, *Chairman*, Chicago, Ill.
J. P. HANLAN, *Vice-Chairman*, Newark, N. J.

C. E. Bartlett...............Philadelphia, Pa.
W. E. Derwent................Rockford, Ill.
Norman J. Griffiths..........Brooklyn, N. Y.
A. W. Humm.............New York, N. Y.
Stanley E. Little................Lorain, Ohio
N. McManamy.............Kansas City, Mo.
Clare N. Stannard.............Denver, Colo.
J. R. Stetser................Gloucester, N. J.
Dorsey R. Smith..............Baltimore, Md.
Wendell L. Smith.........Battle Creek, Mich.
Alan P. Tappan..............Mansfield, Ohio
J. D. Taylor.................Baltimore, Md.

INDUSTRIAL GAS SECTION

MANAGING COMMITTEE

R. M. SEARLE, *Chairman*, Rochester, N. Y.
E. J. STEPHANY, *Vice-Chairman*, Pittsburgh, Pa.

J. B. Allington.............Rochester, N. Y.
F. F. Cauley.....................Chicago, Ill.
H. H. Clark.....................Chicago, Ill.
D. J. Harding......................York, Pa.
H. M. Henry.......................Toledo, O.
J. P. Leinroth..................Newark, N. J.
H. O. Loebell...............New York, N. Y.
E. D. Milener.................Baltimore, Md.
R. E. Ramsey...............Philadelphia, Pa.
W. T. Rasch................New York, N. Y.
J. F. Reynolds..............New York, N. Y.
F. M. Rosenkrans..........New York, N. Y.
A. A. Schuetz...............Milwaukee, Wis.
N. T. Sellman..............New York, N. Y.
H. H. Smith...................Boston, Mass.
H. Vittinghoff..................Boston, Mass.

NOMINATING

E. D. MILENER, *Chairman*, Baltimore, Md.

H. H. Smith.................Boston, Mass.
E. J. Stephany................Pittsburgh, Pa.

MANUFACTURERS' SECTION

MANAGING COMMITTEE

F. A. LEMKE, *Chairman*, Kalamazoo, Mich.
GEO. W. PARKER, *Vice-Chairman*, St. Louis, Mo.

M. E. Abbott, Taunton, Mass. (Gas Sales of N. E.)
E. P. Bailey, Jr., Cleveland, Ohio
C. E. Bartlett, Philadelphia, Pa. (New Jersey & Pennsylvania)
D. J. Collins, Philadelphia, Pa.
Wm. M. Crane, New York, N. Y.
A. E. Creviston, Baltimore, Md. (Southern)
J. S. DeHart, Jr., Newark, N. J.
E. S. Dickey, Baltimore, Md.
J. J. Greene, New York, N. Y.
W. R. Gibson, Toronto, Ont., Can. (Canadian)
E. W. Hammond, San Francisco, Cal. (Pacific Coast)
F. H. Knapp, Pittsburgh, Pa.
Charles McCullough, Milwaukee, Wis. (Wisconsin)
Donald McDonald, New York, N. Y.
H. R. Maxon, Muncie, Ind.
E. A. Norman, New York, N. Y.
A. E. Norton, Boston, Mass. (N. E. Gas Eng.)
J. F. Parker, Rockford, Ill. (Indiana)
E. W. Roberts, Detroit, Mich.
Geo. D. Roper, Rockford, Ill. (Illinois & Iowa)
C. H. Seidenglanz, Dallas, Texas (South Central)
O. P. Simler, Lorain, Ohio
W. L. Smith, Battle Creek, Mich. (Michigan)
T. Stites, Gloucester, N. J.
W. H. Tappan, Mansfield, Ohio

DIVISION OF MANUFACTURERS

Accessories

Earl W. Roberts .... Detroit, Mich.

Apparatus and Works

D. J. Collins .... Philadelphia, Pa.

Gas Range

W. H. Tappan .... Mansfield, Ohio

Heating Appliance

E. P. Bailey, Jr. .... Cleveland, Ohio

Industrial Appliance

H. R. Maxon .... Muncie, Ind.

Lighting Appliance

Townsend Stites .... Gloucester, N. J.

Meter

Donald McDonald .... New York, N. Y.

Office Labor Saving Devices

E. A. Norman .... New York, N. Y.

Supply

J. J. Greene .... New York, N. Y.

Water Heater

O. P. Simler .... Lorain, Ohio

EXHIBITION

F. A. LEMKE, *Chairman*, Kalamazoo, Mich.
C. W. BERGHORN, *Secretary*, New York, N. Y.

Eugene E. Basquin........New York, N. Y.
W. H. Jefferson........New York, N. Y.
B. B. Kahn........Hamilton, Ohio
W. L. Smith........Battle Creek, Mich.

NOMINATING

J. S. DEHART, JR., *Chairman*, Newark, N. J.

Howard Bruce........Baltimore, Md.
Stanley Grady........Philadelphia, Pa.

PUBLICITY AND ADVERTISING SECTION

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S. J. Franklin, Millville, N. J. (New Jersey)
Wm. Gould, Boston, Mass. (N. E. Gas Eng.)
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NOMINATING

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A. C. Howard, New York, N. Y.
C. W. Hoy, Glassboro, N. J. (New Jersey)
J. J. Humphreys, Montreal, Can. (Canadian)
G. M. Johnson, South Bend, Ind. (Indiana)
B. F. Lyons, Beloit, Wis. (Wisconsin)
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C. R. Prichard, Lowell, Mass. (N. E. Gas Eng.)
R. B. Richardson, Peoria, Ill. (Illinois)
W. H. Sedberry, Marshall, Texas (South Central)
W. J. Serrill, Philadelphia, Pa.
F. W. Sperr, Jr., Pittsburgh, Pa.
H. Vittinghoff, Boston, Mass.
L. J. Willien, Boston, Mass.

CARBONIZATION AND COMPLETE GASIFICATION OF COAL

R. G. Porter, *Chairman,* Chester, Pa.
W. E. Steinwedell, *Chairman,* Builders Section, Cleveland, Ohio.
W. R. Morris, *Chairman,* Complete Gasification of Coal Section, Jersey City, N. J.
C. V. McIntire, *Chairman,* Low Temperature Carbonization Section, New York, N. Y.
A. C. Klein, *Chairman,* Operators Section, Boston, Mass.

Vernon Baker....St. Louis, Mo.
J. A. Brown....Jackson, Mich.
E. H. Bauer....Worcester, Mass.
C. R. Bellamy....Syracuse, N. Y.
F. G. Curfman....New York, N. Y.
Dr. Harry A. Curtis....South Clinchfield, Va.
Wm. A. Dunkley....Memphis, Tenn.
Jos. D. Davis....Pittsburgh, Pa.
J. S. DeHart, Jr....Newark, N. J.
Prof. D. J. Demorest....Columbus, Ohio
O. B. Evans....Philadelphia, Pa.
F. J. Kennedy....New York, N. Y.
A. C. Klein....Boston, Mass.
W. R. Morris....Jersey City, N. J.
S. E. Nims....Rockford, Ill.
Wm. W. O'Dell....Pittsburgh, Pa.
Prof. S. W. Parr....Urbana, Ill.
A. I. Phillips....New York, N. Y.
S. B. Sherman....Racine, Wis.
Prof. R. S. Tour....Cincinnati, Ohio
J. H. Taussig....Philadelphia, Pa.
Henry L. Underhill....Baltimore, Md.
A. W. Warner....Chester, Pa.
Leigh Wickham....St. Louis, Mo.
Carl J. Wright....New York, N. Y.
Wm. H. Wright....New York, N. Y.
Geo. E. Whitwell....Tacoma, Wash.
L. J. Willien....Boston, Mass.

BUILDERS' SECTION

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Vernon Baker....St. Louis, Mo.
C. R. Bellamy....Syracuse, N. Y.
F. G. Curfman....New York, N. Y.
J. S. DeHart, Jr....Newark, N. J.
F. J. Kennedy....New York, N. Y.
J. H. Taussig....Philadelphia, Pa.
Henry L. Underhill....Baltimore, Md.
Leigh Wickham....St. Louis, Mo.
Wm. H. Wright....New York, N. Y.

COMPLETE GASIFICATION OF COAL SECTION

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O. B. Evans....Philadelphia, Pa.
Wm. W. O'Dell....Pittsburgh, Pa.
Prof. R. S. Tour....Cincinnati, Ohio
A. W. Warner....Chester, Pa.
Geo. E. Whitwell....Tacoma, Wash.
L. J. Willien....Boston, Mass.
Carl J. Wright....New York, N. Y.

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Dr. Harry A. Curtis...South Clinchfield, Va.
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Prof. D. J. Demorest....Columbus, Ohio
O. B. Evans....Philadelphia, Pa.
S. E. Nims....Rockford, Ill.
Prof. S. W. Parr....Urbana, Ill.
A. I. Phillips....New York, N. Y.
S. B. Sherman....Racine, Wis.
L. J. Willien....Boston, Mass.

CAST IRON PIPE STANDARDS

Walton Forstall, *Chairman,* Philadelphia, Pa.

H. T. Hirst....Chicago, Ill.
L. R. Lemoine....Philadelphia, Pa.
W. Cullen Morris....New York, N. Y.
G. I. Vincent....Syracuse, N. Y.

CHEMICAL

A. C. Fieldner, *Chairman,* Pittsburgh, Pa.

W. M. Berry..............Los Angeles, Cal.
E. F. Coffman..................Camden, N. J.
W. H. Fulweiler............Philadelphia, Pa.
Caleb Davies, Jr............Youngstown, Ohio
J. V. E. Dickson............New York, N. Y.
E. L. Hall......................Portland, Ore.
L. B. Jones..............San Francisco, Cal.
A. A. Kohr................Jersey City, N. J.
Prof. O. L. Kowalke...........Madison, Wis.
C. A. Lunn..................New York, N. Y.
Prof. Jerome J. Morgan.....New York, N. Y.
C. A. Schnerr...................Chicago, Ill.
C. H. Stone.................Rochester, N. Y.
C. C. Tutwiler.......West Conshohocken, Pa.
E. C. Uhlig...................Brooklyn, N. Y.
J. M. Weiss.................New York, N. Y.
L. J. Willien....................Boston, Mass.
Prof. D. W. Wilson.....Orchard Park, N. Y.
Dr. J. F. Wing.................Boston, Mass.
J. R. Wohtley..............New York, N. Y.

SUB-COMMITTEES

Co-operative Analyses and Tests of Light Oils and Tars

J. M. Weiss, *Chairman,* New York, N. Y.

J. V. E. Dickson...........New York, N. Y.
C. C. Tutwiler.......West Conshohocken, Pa.

Co-operative Tests of Ammonia Liquors and Materials

C. H. Stone, *Chairman,* Rochester, N. Y.

J. J. Morgan...............New York, N. Y.
D. W. Wilson...........Orchard Park, N. Y.

Co-operative Tests of Purifying Oxides

W. A. Dunkley, *Chairman,* Memphis, Tenn.

W. L. Kohlman............New York, N. Y.
C. A. Schnerr...................Chicago, Ill.

Testing and Valuation of Gas Oils

C. A. Lunn, *Chairman,* New York, N. Y.

W. H. Fulweiler............Philadelphia, Pa.
R. B. Harper...................Chicago, Ill.

COKE

V. A. Miller, *Chairman,* Rochester, N. Y.

E. H. Bauer................Worcester, Mass.
Thos. D. Miller...............St. Louis, Mo.
W. G. Rich.................Providence, R. I.
W. A. Selvig................Pittsburgh, Pa.

DEPOSITS IN GAS PIPES AND METERS

Dr. R. L. Brown, *Chairman,* Pittsburgh, Pa.

W. A. Castor...............Philadelphia, Pa.
A. F. Kunberger............Philadelphia, Pa.
O. A. Morhous..........Astoria, L. I., N. Y.
W. W. O'Dell.............Washington, D. C.
E. P. Pohlmann.................Chicago, Ill.
E. C. Uhlig...................Brooklyn, N. Y.
H. Vittinghoff.................Boston, Mass.
Dr. J. F. Wing.................Boston, Mass.

DISPOSAL OF WASTE FROM GAS PLANTS

L. J. Willien, *Chairman,* Boston, Mass.

T. S. Barlow...............New York, N. Y.
J. E. Brewer........West Conshohocken, Pa.
I. T. Haddock.............Cambridge, Mass.
Arthur Hewitt.........Toronto, Ont., Canada
T. J. Kelly.....................Lafayette, Ind.
J. S. Kennedy.............New York, N. Y.
G. T. Macbeth............Mt. Vernon, N. Y.
F. W. Sperr, Jr...............Pittsburgh, Pa.
R. E. Wyant..............New Haven, Conn.

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R. G. Griswold, *Chairman,* New York, N. Y.

H. B. Anderson............Philadelphia, Pa.
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W. M. Henderson........San Francisco, Cal.
A. C. Howard...............New York, N. Y.
J. D. von Maur.................St. Louis, Mo.
Chas. Wilde.....................Chester, Pa.

FUNDAMENTALS OF CONDENSING AND SCRUBBING

W. H. Earle, *Chairman,* Rochester, N. Y.

J. A. Brown..................Jackson, Mich.
Gray J. Houston...............Denver, Colo.
N. H. Memory................Newark, N. J.
F. W. Steere..................Detroit, Mich.
G. H. Waring...........Grand Rapids, Mich.
J. R. Wohrley..............New York, N. Y.

HOLDERS

H. E. Bates, *Chairman,* Chicago, Ill.

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John H. Braine..............Brooklyn, N. Y.
R. B. Harper....................Chicago, Ill.
R. E. Sperry.................Baltimore, Md.

MEASUREMENT OF LARGE VOLUMES OF GAS

M. E. Benesh, *Chairman,* Chicago, Ill.

R. C. Cornish.............Philadelphia, Pa.
L. R. Dutton...............Jenkintown, Pa.
Geo. A. Lane....................Chicago, Ill.
M. I. Mix.......................Chicago, Ill.

NOMINATING

C. N. Chubb, *Chairman,* Davenport, Iowa

J. A. Brown..................Jackson, Mich.
G. I. Vincent.................Syracuse, N. Y.

PROGRAM OF RESEARCH

Dr. J. F. Wing, *Chairman,* Boston, Mass.

A. C. Fieldner................Pittsburgh, Pa.
Prof. O. L. Kowalke...........Madison, Wis.
C. A. Lunn................New York, N. Y.

PURIFICATION

(Sub-Committee of Chemical Committee)

Dr. A. R. Powell, *Chairman,* Pittsburgh, Pa.

J. B. Craven....................Chicago, Ill.
Wm. A. Dunkley............Memphis, Tenn.
A. C. Fieldner...............Pittsburgh, Pa.
W. L. Kohlman..............Brooklyn, N. Y.
C. E. Littell...............New Haven, Conn.
F. W. Sperr, Jr...............Pittsburgh, Pa.
Dr. J. F. Wing.................Boston, Mass.

REFRACTORY MATERIALS

W. H. Fulweiler, *Chairman,* Philadelphia, Pa.

E. H. Bauer................Providence, R. I.
W. H. Earle................Rochester, N. Y.
R. B. Harper....................Chicago, Ill.
R. D. Hatton..................St. Louis, Mo.
C. A. Lunn.................New York, N. Y.
G. T. Macbeth............Mt. Vernon, N. Y.
Kenneth Seaver..............Pittsburgh, Pa.
O. K. Smith................Davenport, Iowa
H. Vittinghoff.................Boston, Mass.

SPECIFICATIONS FOR GAS COAL

Harold J. Rose, *Chairman,* Pittsburgh, Pa.

W. R. Addicks............New York, N. Y.
F. R. Haas...............Fairmont, W. Va.
Chas. E. Lewars...........Portsmouth, Ohio
F. R. Wadleigh............Washington, D. C.
Dr. J. F. Wing................Boston, Mass.

STANDARDIZATION OF CAPACITIES OF CONSUMERS' METERS

Walton Forstall, *Chairman,* Philadelphia, Pa.

H. S. Bean...............Washington, D. C.
W. C. Beckjord.............New York, N. Y.
W. Griffin Gribbel...........Philadelphia, Pa.
A. H. Hall.................New York, N. Y.
Donald McDonald..........New York, N. Y.
T. V. Purcell....................Chicago, Ill.
George Wehrle................Denver, Colo.

SUB-COMMITTEE

Existing Meter Types

G. A. LANE, *Chairman,* Chicago, Ill.

E. J. Bartel . . . . Brooklyn, N. Y.	Walton Forstall . . . . Philadelphia, Pa.
H. S. Bean . . . . Washington, D. C.	John D. McIlhenny, Jr. . . . . . . Philadelphia, Pa.
Thos. E. Boyd . . . . Denver, Colo.	Norton McKean . . . . Boston, Mass.
W. A. Castor . . . . Philadelphia, Pa.	J. H. Muller . . . . New York, N. Y.

D. A. Powell . . . . Milwaukee, Wis.

MINUTES OF GENERAL SESSIONS

FIRST SESSION

Tuesday Morning, October 16, 1923

The fifth annual convention of the American Gas Association was called to order by the president, Mr. R. B. Brown, the attendance being approximately 1200 members and guests.

The President: Will the meeting please come to order! We are blessed with wonderful weather. Apparently we have a big turnout. The Manufacturers Section, as you cannot fail to have noted, has provided for us a wonderful display, and we have a program that I think will prove of great interest and value to you. But that program crowds our time very heavily and I will ask that everyone who has occasion to enter into any discussion, in the General Sessions particularly, will confine his attention strictly to the subject at hand and make everything as brief as possible.

The first order of business is the reading of the minutes of the last meeting. It has been customary to dispense with this and the chair will be glad to entertain a motion to that effect.

MINUTES OF PREVIOUS MEETING

(Upon motion, seconded and carried, the reading of the minutes of the previous meeting was dispensed with.)

REPORT OF THE SECRETARY-MANAGER FOR THE YEAR ENDED SEPTEMBER 30, 1923

Oscar H. Fogg, New York, N. Y.

The Secretary-Manager has come to a long anticipated time—the time when the Association is functioning in such a way, and the news of its activities is so thoroughly and systematically disseminated to its membership of all classes, that a report of its headquarters executive would in reality be superfluous. Whatever report I can make, therefore, must of necessity be a repetition. But I do wish to refer specifically to several matters that I think are of particular interest to this convention.

We have passed the coveted goal of 500 gas company members. There are now

503 gas company members
17 holding company members
265 manufacturer company members
2,209 individual members
2 honorary members

We think that this is a convincing record of the place which the Association has come to occupy.

More than a year ago we set out to perfect and place upon a more practical working basis, the relations between the A. G. A. and its affiliated associations along lines indicated in my report of last year. I am glad to report the most gratifying progress in this effort, which is in a large part due to the work of Mr. Kurwin R. Boyes, who came to the A. G. A. from the Providence Gas Company. He has most capably applied himself to the coordination of state and national association activities and to increasing the helpfulness and value of the national association to its affiliated associations.

With respect to the Association's national activities, as differentiated from the activities of its sections, it may be said without exaggeration that they have become of greater importance and have been accompanied by results of immeasurable benefit to the gas industry in all sections of the country.

I have omitted from this report any specific reference to the work of our general committees, for the substance of that is to come before you at this meeting. In the aggregate, the results which have been obtained through their efforts are beyond estimate.

Publications

I have referred at some length in previous reports to the regular and special publications of the Association. It has been our constant effort to improve them in quality and character and to increase their value to our membership.

Consulting Counsel

The Association was particularly fortunate in taking the action which resulted in the employment as consulting counsel of Mr. Carl D. Jackson, for-

merly the Chairman of the Wisconsin Utilities Commission. His services, which we share jointly with the National Electric Light Association, have enabled the American Gas Association to render to its members a service, the value of which I cannot adequately express.

In concluding this report I want to devote a moment to the headquarters organization. Mr. A. Gordon King, formerly of the New York and later of the Pennsylvania Commission, now occupies the post so ably filled in the past by Mr. Alfred I. Phillips, as Service Engineer. To my immediate assistants, Messrs. Stotz and Sellman, to Mr. Scofield, in general charge of our editorial and statistical work, to the unfailing and capable secretaries of our sections, Messrs. Hartman, Person and Berghorn, to Mr. Geo. G. Ramsdell and to the other members of our headquarters force whom I would like to but cannot individually name, I want to express my deepest appreciation both for their ability and their undivided loyalty to the interests of the Association and also for the spirit that has made the duties of the Secretary-Manager a pleasure rather than a task.

(Upon motion, seconded and carried, the report of the Secretary-Manager was accepted.)

ELECTION OF ACTIVE (INDIVIDUAL) MEMBERS

The assistant secretary-manager reported the following applications for membership as received during the period October 1, 1922, to September 30, 1923, such applications having all had the approval of the Executive Board.

Gas Companies	57
Manufacturer Companies	59
Individuals	315

(Upon motion, duly seconded and carried, all applications as presented for active individual membership were accepted, the secretary-manager casting one unanimous ballot for their election.)

On call from the president for report of the Treasurer, Mr. H. M. Brundage responded, prefacing his report by the following remarks:

H. M. Brundage (New York, N. Y.): This looks like a fine pulpit to speak from, and I am glad to bring you a message of optimism. We have had a pretty good year.

REPORT OF TREASURER

Statement of Cash Received and Disbursed—Between October 1, 1922 and September 30, 1923

BALANCE:

Cash on hand October 1, 1922:				
Corn Exchange Bank			$16,687.29	
Office Cash Funds			2,000.00	
Total				$ 18,687.29

RECEIPTS

DUES AND MEMBERSHIPS:

Membership Dues:				
Individuals	$ 14,656.00			
Companies	152,757.62			
		$167,413.62		
Subscriptions:				
Proceedings	$ 733.05			
Bulletin of Abstracts	1,377.50	2,110.55		
Total			$169,524.17	

OTHER REVENUE:

Interest:				
On Bank Balances	$ 957.84			
On Securities Owned	3,429.10			
		$ 4,386.94		
Miscellaneous:				
Sale of Publications and Merchandise, etc.	$ 13,322.08			
Entertainment Tickets, Booth Space and other Items Applicable to Convention and Exhibition:				
1922	$ 15,538.95			
1923	28,839.00	57,700.03		
Total			$ 62,086.97	

MISCELLANEOUS RECEIPTS:

Redemption of United States Victory 4¾% Bonds		$ 15,000.00		
For Service and Expenses of Industrial and Service Engineers		910.02		
Membership Dues Prepaid for 1924-1925		340.50		
Bulletin of Abstracts Prepaid for 1924-1925		2.50		
Advertising Copy Service		12,415.00		
Miscellaneous Items		138.43		
Total			$ 28,806.45	
Gross Receipts				260,417.59
Total				$279,104.88

DISBURSEMENTS

INVESTMENTS AND CAPITAL EXPENDITURES:

Furniture and Fixtures Purchased		$ 1,486.26		
Motion Picture Film		3,949.50		
United States Government Liberty Bonds Purchased, (Par Value $30,000.00)		29,511.00		
Total			$ 34,946.76	

PUBLICATION EXPENSES:

Monthly Bulletin		$ 6,673.66		
Bulletin of Abstracts		2,309.26		
Proceedings		6,022.52		
Service Letters		1,460.96		
Advertising Copy Service		12,198.50		
Publications and Merchandise for Re-sale		11,552.45		
Total			$ 40,217.35	

GENERAL EXPENSES:

Special and Sectional Activities		$ 17,664.95		
Memberships in Other Organizations		1,367.50		
Traveling, Investigation and Field Work of Secretary-Manager, Industrial Engineers and Other Members of Association Staff		8,910.26		
Convention and Exhibition Expenses:				
1922		37,624.79		
1923		8,126.21		
Office Expenses:				
Rent and Light	$ 9,819.81			
Salaries	72,606.63			
Stationery, Printing and Supplies, etc.	4,986.05			
Telephone, Telegraph and Postage	4,604.67			
Miscellaneous—General	1,795.76			
		93,812.92		
Membership List—Booklets		867.92		
Washington Information Service		1,200.00		
General Counsel		7,875.00		
Committee on Public Utility Fuel		2,389.22		
Executive Board and Committee Meetings—Stenographic and Reporting Work, etc.		733.57		
Resucitation Research—Professional Services and Expenses		1,868.44		
Total			182,440.78	
Total Disbursements				257,604.89

BALANCE—CASH ON HAND SEPTEMBER 30, 1923:

Corn Exchange Bank	$ 20,499.99	
Office Cash Funds	1,000.00	
Total		21,499.99
Total		$279,104.88

CONDENSED GENERAL BALANCE SHEET—SEPTEMBER 30, 1923

ASSETS

INVESTMENTS:

United States Government Liberty Bonds, (Par Value $71,200.00)		$ 69,329.00

OFFICE AND GENERAL EQUIPMENT:

Furniture and Fixtures	$ 15,589.46	
Library	2,438.44	
Motion Picture Film	3,949.50	
Total		$ 21,977.40

CURRENT ASSETS:

Cash in Bank and on Hand as per Exhibit "B"	$ 21,499.99	
Accounts Receivable:		
Membership Dues—Individuals	824.00	
Miscellaneous—(Schedule No. 1)	6,536.04	
Total		$ 28,860.03

DEFERRED ASSETS:

Publications—(Estimated Value of Inventory)	$ 3,000.00	
Interest Accrued on Securities Owned	469.64	
Total		3,469.64
Total		$123,636.07

LIABILITIES

CURRENT LIABILITIES:

Audited Vouchers Payable		$ 801.56

SERVICE LIABILITIES:

Dues Prepaid—Individuals	$ 355.50	
Bulletin of Abstracts—Subscriptions Paid for in Advance	2.50	
Total		$ 358.00

BALANCE:

Excess of Assets over Liabilities September 30, 1922, as per Books	$109,065.19	
ADD:		
Increase for the Year	13,411.32	
TOTAL EXCESS OF ASSETS OVER LIABILITIES		122,476.51
Total		$123,636.07

ACCOUNTS RECEIVABLE

Advertising Copy Service	$ 390.00
Abstract Subscriptions	50.00
Exhibition Space Rentals	4,766.00
Proceedings Sales	25.75
Publication and Merchandise Sales	1,036.53
Services and Expenses of Industrial and Service Engineers	267.76
Total	$6,536.04

(Upon motion, seconded and carried, the report of the Treasurer was accepted.)

(During the reading of the president's address, Mr. J. B. Klumpp, Vice-president, assumed the chair.)

ADDRESS OF THE PRESIDENT

R. B. Brown, Milwaukee, Wis.

We are always more or less victims of custom or precedent and right now you and I will bow to a custom which, if it ever had a justification, probably could not now be proved to be essential in any way to a successful meeting.

We are gathered here today at very heavy cost of time, effort, and money, to consider the general health of the gas industry; to learn what we can of new methods, of new problems in manufacture and distribution, and of solutions that have been found for them; of new thoughts on rates and rate structures and the analyses on which they may be based; of new appliances and of new uses for gas which are being developed every day; and last, though not least, to learn of new methods of sharing our current knowledge of all these with our customers.

In short, we are here to study, to learn, and though conference and exchange of ideas and experiences, to teach; therefore, I shall waste very little of your collective time on this tribute to custom and precedent.

Last year we left Atlantic City hoping and believing that our industry was well on the road to a bigger, better, more useful business than it had ever before been called upon to serve. The year closing now has indeed justified the hope. In the years that I have been privileged to serve with this industry, there surely has never been a more substantial present or a more assured future than we face today.

Last year we were erased offhand from the picture of our country's future development by a well-known student of business economics. We have occasionally been accused of tardiness or utter inability to grasp our opportunities or to measure up to our responsibilities, *but,* as we look back over the troubled years of the great war and the more troubled ones that followed; as we study the statistics of growth through all that period and still continuing; as we realize the ever-increasing difficulties attending physical expansion in our big cities, we surely can be pardoned if we feel some satisfaction in having been associated with a service whose "made-good" percentage has been so high.

Handicapped by increasing costs; inadequate and unscientific rates; new problems of manufacture induced by veritable chaos in the markets for raw materials, and eventually by impaired credits; yet, in spite of all, the gas industry as a whole, gave very close to 100% service and at rates which never even approached the increases found necessary in almost every other item contributing to our national living expense. The point is that WE did all this and survived.

The detailed story of how this really remarkable feat was accomplished, would take too long in the telling, but it would most emphatically give the lie to

most of the slams which have been handed the gas industry and its personnel in the past. Self-satisfaction is a very dangerous attitude of mind, but at the same time, it will not do gas men any harm occasionally to check up the steps already taken upon the always rocky road to greater and more efficient utilization of all opportunities, while at the same time taking a good look over the nearby obstacles which they have yet to put behind them in the not distant future.

The old-timer with the whole job to do, has given way in large measure (as in most other lines) to the departmental specialist, and each and every one of them finds no lack of problems pressing for solution in his own special field. There are so many of these that even to enumerate them would weary you, but I may at least touch on a few of the most important by classes.

We need standardization of manufacturing methods, and, if possible, more flexible and cheaper (per unit of output) manufacturing plant. This plant should be capable of utilizing qualities of raw materials not now generally usable, and aid in releasing some of our natural resources which are more valuable for other purposes. Such plant should preferably lead to the manufacture of gas rather than of by-products, thus simplifying a necessarily complex sales and distribution problem.

For those who are looking for sensational developments in manufacturing plant, I would recommend a careful study of this year's technical reports by the Carbonization Committee and others, which I think will convince anyone that anything sensational in the way of reduction of plant cost, will have to come though a radical change in our ideas as to the character of gas which can be successfully distributed. Any practical demonstration along these lines will have to follow and can not precede equally radical changes in the regulations promulgated by our state authorities. One such recent change may produce definite experimental data, and it is to be hoped that it will, for after all, a good many of the possibilities that are being discussed, will have to be put to the acid test of public demonstration before we can absolutely determine their strength or weakness. Laboratory tests, no matter how carefully carried out, do not always determine the limiting commercial features of new processes or methods.

We need more business of such a character as to increase or at least to maintain through diversity of hourly, daily, seasonal demand, our plant and distribution load factors. The field for the development of new business is practically unlimited, but in its development, grave dangers exist and most careful study should be made of the characteristics of each source of new revenue before anything is done to commit us to its service. In this study a more general understanding of the fundamentals underlying scientific rate structure will be of the utmost advantage.

Our composite business of today with its three hundred maximum days of plant output and its twenty-two hundred hours' use of the maximum hours' demand on distribution system, corresponding to 82%, and 25% load factors respectively, is something distinctly to be spoken of with respect. I wonder how many gas men realize that only a very few of our consumers attain to anywhere near these load factors; that diversity in hourly, daily, seasonal demand builds up these load factors, and that

any prospective business of markedly lower load factor characteristics, especially if it presents serious peak loads, must have ample diversity or a complementary load or we will soon tremendously increase our overheads per unit of output through sharp decreases in load factor.

To get this much to be desired additional business, we must have rates based, so far as practicable, on the facts as to cost of service as shown by actual analysis of our present costs, modified to fit the conditions of each demand. In general, high demands mean low annual load factors. There are exceptions but they are very few in number.

Demand rates based on a clear understanding of the two-fold nature of demand in the gas business (momentary demand on distribution capacity and 24-hour or longer demands on manufacturing capacity) will eventually, I hope and believe, save us from the dangerous class of new business and enable us to obtain much more of the desirable kind.

Controversial matters should, perhaps, be excluded on such an occasion, but it is hard for me to dodge a clean-cut issue just because all men don't agree on it. Moreover, one should have the courage of his convictions; so here are mine on the subject of gas for house heating.

I have been a close student of this problem for over twenty-five years and have accumulated considerable in the way of physical facts on its application to that use. In our Northern climate, you can sell to your house heating consumer, who uses no other artificial heat, 90 to 100 times his maximum 24 hours' demand—one-third of the usual load factor on the total sales we now enjoy.

A careful study of every commercially practicable gas manufacturing process now before us, and of every modification of present methods of distribution, either in use or being discussed, has convinced me that for the immediate future at least, and at the present purchasing value of the dollar, we can not duplicate present existing plant capacity for what that plant actually cost.

Now the greatest single item of cost to our industry is that group of so-called fixed costs—interest, depreciation, and taxes, which are roughly based on the capital used. This capital used will always be proportioned to the load factor —or, we'll say, to the amount of gas you can sell per year for each unit of daily capacity in your plant. The maximum you *can do* is to sell all the gas your plant will make each and every day in the year, and that particular millenium will probably never be reached. There are situations where a considerable excess of plant capacity, both manufacturing and distribution, exists, due to peculiarities of expansion, in which cases it may seem that such capacity can be loaded up by taking on house heating without regard to true cost of service, but in any situation where any appreciable additional business requires direct extensions of works and distribution capacity (and most of us find ourselves in that position) the cost and return on the additional capacity must be considered. Any gas man, who on faith as to some hypothetical future development, deliberately cultivates a business of tremendous potential volume, which can not show even reasonably good load factor, and on rates less than the true cost of service, surely courts disaster.

There are several ways out, but the surest one to my mind lies in obtaining a rate structure based on an honest, fearless analysis of the actual costs of supplying such a demand. We may not

have sufficient data to say the last word on this subject at this time, but we certainly can set up a cost basis which will make possible the erection of a demand rate on which the house heating customer will pay *nearly* all the costs occasioned by his demand.

With such a rate in force, you need not fear the house heating business. It will be a luxury—well worth its cost to those who can afford it, and as it will pay its way, we can go after it, and I believe that you will be surprised at the amount of house heating which can be had, even on a basis of actual cost to serve.

Another solution, the development of which is actually going on with almost every gas company's business today, is the use of gas for auxiliary heating. As compared with the use of gas for exclusive house heating, this shows a very much better load factor. In fact, in many instances as much as 200 maximum days may be expected, and that sort of a load factor is so much better than the best that may be obtained from an exclusively gas-fired installation, that it will not throw a prohibitive burden upon the industry, and as the actual growth of demand rates may be slow and difficult, it is very fortunate that this is so.

These problems are greatly accentuated when one considers the tremendous amount of industrial business available, much of it of splendidly attractive load factor characteristics; and when one realizes that the enforced sale of a tremendous amount of gas on the exclusively house heating basis, *without* the demand rate, is certain to be done at a loss, and that this loss will have to be made up by substantial additions to the price at which much more satisfactory industrial business could be had, it is easy to see that any mistake in policy in the handling of this prospective heating load, will be a two-edged sword. It will cut down materially the possibilities of industrial business and will, at the same time, by cutting our total load factor, tremendously increase the cost per thousand feet of gas sold.

An effective demand rate, enforced by demand limiting devices, is one of the most pressing needs and would solve many present and prospective problems of the industry.

The plant to care for all this coming business, translated into concrete, refractories and steel, will take tremendous additions of capital, and we must get it from those whom we serve. They have by far the greatest interest as a class in this whole series of problems of ours, and when made to see it, will not only support our financial needs, but will, I am confident, enable us to obtain the rates and other conditions necessary to successful progress in our effort to increase the scope and value of our service to them—the public.

And that brings me to another and perhaps the most pressing of our needs, and that is the education of the public to a better appreciation of all these matters. They will be interested—their own interests are at stake—and if the details are intensely interesting to us, they will also be to our customers and to the representatives if we can get the story over to them.

In a very brief way, I have perhaps outlined the excuse for the existence of the American Gas Association. To every one of the queries and needs above enumerated, and to many others, you will find some answer to our program or at least will find earnest efforts being made by organized groups of

picked men to obtain such answers for you.

The thought I would like to advance is this: The work on committees and boards of this Association, if well done, is a burden on the individual and an ever-increasing expense to the companies —but! it is as absolutely necessary to the future success of our industry as any other half dozen factors in the conduct of the business. From an educational standpoint alone, it is worth all it costs and more to individual or company. So, when the call comes to serve the association, esteem it an opportunity—it is nothing less—and give liberally of your own time in the cause of the industry, knowing full well that you will profit most by so doing.

To those who look on (and all can not be workers in association work) I would add: This work is done for your benefit, you are contributing to its support. Get all you can out of it. Make use of the information provided. Cooperate in the crystallizing of opinion among ourselves as well as among our customers. It is being more and more recognized that a successful industry and a successful national association must go hand in hand, and, if we all do our part, we will continue to have both.

It has been my experience that the more closely one is identified with the work that is being done at A. G. A. headquarters today, the more one is impressed with the excellent organization work which has been done by our very capable Secretary-Manager and his assistants. I don't believe that there is another national association which has as effective and efficient a headquarters staff as we enjoy today. And, while on this subject, it would not be amiss to call your attention to the fact that we have a Board of Directors, many of them the busiest men in the industry, scattered pretty well all over this country, and that at the monthly meetings we have never failed to have a quorum. It can not always be easy for these men to drop their work to attend these meetings for the benefit of the industry as a whole, but they *do* it, and their devotion to the welfare of the association and the industry, is just one evidence of the sort of service that has made and can continue to make the A. G. A. and the industry it represents a success.

The Vice-President: Gentlemen, you have listened to a very interesting and instructive talk from our president. There is probably no one in the industry who is better able to state the gas man's problems of today than Mr. Brown. His experience in the past in bringing a large company through the adversities that have met the gas men has been exceedingly successful. No company has met the adverse legislation or the uncertain activities of municipal regulation as has his company, and when you hear words from Mr. Brown you should give them weight.

COMMITTEE ON PRESIDENT'S ADDRESS

At the close of the president's address the chairman appointed a committee of three, consisting of Messrs. Arthur Hewitt, Charles L. Holman, and Harry A. Norton, to review the address of the president and report on same at the Thursday morning session.

REPORT OF COMMITTEE ON AMENDMENTS TO CONSTITUTION AND BY-LAWS

Wm. J. Clark, *Chairman*, Mt. Vernon, N. Y.

This report is simply in the nature of certain amendments to the Constitution and By-Laws approved by the Executive Board at a regular meeting on March 16, 1923, and later ratified by a majority of the membership voting by mail ballot.

In effect these amendments provide:

1st—For three classes of individual members, A, B, and C.

Class A shall be individual employees of member companies or members in good standing in any state or district gas association with which the A. G. A. is formally affiliated. Annual dues of Class A members are $5.00 for registration in one section and 50¢ for registration in each additional section.

Class B shall be individuals other than those classified under Classes A and C, who are engaged or interested in the advancement of the gas industry. The annual dues of Class B members are $8.00 for registration in one section and 50¢ for registration in each additional section.

Class C shall be instructors or teachers in universities, colleges, scientific institutions or members of the staffs of state utility commissions, government or state bureaus, who are interested in or have jurisdiction or supervision of gas companies. Annual dues for Class C members are $3.00 conferring registration in all sections. Classes B and C are invitation memberships by the Executive Board, which invitations must be renewed annually.

Previous to these amendments there was but one class of active (individual) membership. Individuals who were employees of company members were eligible to enroll on the following basis of dues:

$5.00 for enrollment in one section
7.00 for enrollment in two sections
9.00 for enrollment in three sections
1.00 for enrollment in each additional section.

Individuals who were not in the employ of company members were required to pay annual dues of $15.00 and were enrolled in all sections. Under these amendments it will be noted that a considerable saving is possible by the individual.

2nd—A new Industrial Gas Section was also created during the year making six sections in all now officially organized and in operation.

3rd—Provision has also been made for accepting applications for company membership from companies serving natural gas. The annual dues of natural gas companies are the same as for companies serving manufactured gas, except

in the case of companies which are members of the Natural Gas Association of America; in such cases, the percentage dues on their sales of natural gas *only* are computed as one quarter of 1/30 of 1% of their annual gross sales of natural gas.

These amendments became effective on October 1, the beinning of the Association's fiscal year.

(The amendments as presented by the committee required no action as they had been approved in April, 1923, by ballot of the membership.)

REPORT OF NOMINATING COMMITTEE

CHARLES M. COHN, *Chairman*, Baltimore, Md.

The Nominating Committee, consisting of Messrs. P. H. Gadsden, Fred K. Lane, George W. Parker, T. V. Purcell, A. B. Tenney and myself as Chairman, elected at the Fourth Annual Convention to nominate officers and directors to be voted on at the next annual meeting, beg to submit the following report:

The Committee recommends for the election of President, Vice-President and Treasurer to serve for one year, the following:

For President, J. B. Klumpp, Philadelphia, Pa.

For Vice-President, C. O. G. Miller, San Francisco, Cal.

For Treasurer, H. M. Brundage, New York, N. Y.

For Directors to serve two years:

George B. Cortelyou, New York, N. Y.
Donald McDonald, New York, N. Y.
R. J. Hole, Greensboro, N. C.
J. J. Humphreys, Montreal, Can.
Alfred Hurlburt, Pittsburgh, Pa.
H. C. Abell, New York, N. Y.
Clifford E. Paige, Boston, Mass.
Chas. J. Ramsburg, Pittsburgh, Pa.

(Upon motion, seconded and carried, the president declared the report of the committee on nominations, as relating to officers, unanimously adopted, and the secretary-manager, on instruction, cast one ballot for the election of the officers whose names were presented by the committee.)

REMARKS OF PRESIDENT-ELECT

Mr. President, gentlemen of the American Gas Association, it behooves anyone who has been selected to lead this great organization to be justly proud. The American Gas Association stands for all that is honorable and progressive in the gas industry. It has probably done more to encourage our gas companies to establish good will among the public in this country than any similar organization. I think the strides and the position of the gas utilities in the last five years have evidenced that as a fact.

We know our utilities are the foundations of our municipal governments. The success and failure of the utility

means the success and failure of municipal organizations. The people are beginning to realize that, and I think this Association has done more than we imagine in obtaining the gas man's position there.

The Association cannot be successful unless all of its members cooperate and help us to maintain this position which we now hold, and I trust next year we will be able to carry on the good work that our predecessors have so successfully started, and I ask everybody to cooperate with our administration this coming year in this work.

TELEGRAM FROM VICE-PRESIDENT-ELECT

I am greatly pleased at being honored by the American Gas Association with the office of Vice-President, the more so in being elected during my unavoidable absence. I only received your message of congratulations this morning, having been out of town yesterday and the repeated message being delayed. Many thanks for it.

REMARKS OF TREASURER-ELECT

Mr. President, my recollection is that the salaries, fees and emoluments this Association has paid me has consisted for a number of years of eight cigars, one for each meeting. Notwithstanding, I am glad to serve the Association and contribute to its welfare, and the same loyalty as I have given to his predecessors will be extended to President Klumpp and the new board.

HONORARY MEMBERSHIPS

President Brown announced that since the organization of the American Gas Association it has been the practice to elect to honorary membership the presidents of the gas associations in France and Great Britain, those elections being for the term of their office, the presidents of the American Gas Association having been similarly honored.

(Upon motion, seconded and carried, the recommendation was adopted.)

GREETINGS FROM ABROAD

The President read the following cablegrams from abroad:

From the British Commercial Gas Association, London, England.

"British Commercial heartily reciprocate your message of good will. May success attend your meetings and all your future work for great industry in which we are all brothers.

F. W. GOODENOUGH."

From the Institution of Gas Engineers, London, England.

"Institution of Gas Engineers send fraternal greetings. Best wishes for successful convention and increasing prosperity.

SAMUEL TAGG, *President*."

OBITUARY

W. J. CLARK, Mt. Vernon, N. Y.

When we grasped hands and said our farewells at the close of our last convention and bade Godspeed to those who had worked with us to make that meeting a success, perhaps we gave little, if any, thought at the time that there were some who would never return to these scenes; that some hands we were grasping for the last time here.

It is hard in this busy world to keep in mind such prophetic words as were written by George Eliot, who said: "In every parting, there is the image of death." And it is difficult to hold in appreciation Bayard Taylor's words, who said: "Our life is but the twinkle of a star in God's eternal day."

It is fitting at this hour that we bow our heads and in spirit commune with those gone from us; those who have laid aside the cares and labors of this life and have entered into that peace which passeth understanding. Today, we miss the kindly faces and the helpful presence of those fellow-workers who have passed from our sight. Some of these, perhaps, did not come prominently into our view but were none the less earnest, helpful workers in the industry.

In commenting upon the loss of one of our members, Mr. John A. Britton, who passed away on the western coast, it would seem quite fitting to quote the words which were said of our great leader, President Harding: "If such a stalwart soldier must falter and fall upon life's journey, it is typically appropriate that the end might come out on the western slope of the country he loved so well; out near the 'end of the trail,' by the great Pacific Ocean whose waves might sing him to dreamless sleep; where his weary eyes might gaze upon a golden sunset for the last time before opening again upon a brighter hereafter."

May I ask the Convention to stand while I read the names of those who no longer know in part only; who have ceased to see through the glass darkly; who now have knowledge which shall not vanish away:

John A. Britton, V.P. & G.M., Pacific Gas & Electric Company.

Andrew K. Quinn, Pres.-Treas., Newport Gas Light Company.

John Doyle, Consolidated Gas Company of New York.

F. R. DeVoe, Sec.-Treas., Northern Union Gas Company, New York, N. Y.

H. B. Reinach, Asst. Treas., Consolidated Gas Company of New York.

Harry W. Hunter, President, Baltimore Gas Appliance & Mfg. Co.

D. C. Ebbetts, Pittsburgh Water Heater Company.

Frank J. Baker, V.P., Public Service Co. of Northern Illinois.

J. B. Hill, Welsbach Company.

F. A. Hooker, Northern Union Gas Company of New York.

Roy M. Buell, Efficiency Engineer, Melbourne, Australia.

Edward S. Bliss, Springfield Gas Light Company, Springfield, Mass.

C. N. Jelliffe, American Light & Traction Company, N. Y.

REPORT OF THE COMMITTEE ON TIME AND PLACE

S. E. Mulholland, *Chairman,* Ft. Wayne, Ind.

As was true in 1922, the splendid growth of our Association and the large enthusiastic attendance again this year limits the selection of a suitable place for the 1924 convention to those cities having adequate hotel and exhibition facilities. The Association has grown to such proportions that adequate room must be provided to meet the situation.

Invitations have been received for the 1924 convention and exhibit to be held in the cities of Chicago and St. Louis.

While your committee is advised of the fact that the referendum vote on place of holding the convention for 1923 and 1924 by a large majority favored the city of Chicago for the 1924 convention, it is nevertheless, true that the present facilities in Chicago for the exhibition feature of the convention are not as they were expected they would be when the vote was taken, it being believed at that time that the new Hotel Stevens would be completed sufficiently early to permit the holding of the convention and exhibition under one roof.

In view of the fact that there is a serious question in the minds of your committee as regards the facilities that could be provided in 1924, and not having sufficient time at its disposal to make such complete investigation of these matters as the situation demands, and further realizing the great importance of due consideration being given to the geographical location of the membership, it is the judgment of your committee that the matter be referred to the Executive Board of the American Gas Association for investigation and decision.

(Upon motion, seconded and carried, the recommendation of the committee on time and place was adopted.)

The president then invited Mr. B. J. Mullaney, chairman of the Publicity and Advertising Section, to occupy the chair during the presentation of an address on behalf of that section by the Hon. Lewis E. Gettle on the subject:

THE IMPORTANCE OF STATE COMMITTEE WORK AS REGULATORY BODIES SEE IT

Hon. Lewis E. Gettle, Chairman, Railroad Commission of Wisconsin.

The public service commission has a more intimate personal contact with the human elements as well as the physical details presented in matters within its jurisdiction, than has any other administrative, judicial or quasi-judicial body. Much of its most productive work is educational, directive, inspirational, formative. Even in controversial matters it more often acts as a benevolent intermediary, pointing the way to amicable and just mutual adjustment, than as an implacable judge guided by irrevocable precedents. The commissioner's very character, moral convictions and mentality are interwoven in products of his administration. The commission as a body politic can never rise any higher in worth and value than the honesty, knowledge, sense of right and justice of the individual who occupies the office. The commission from the very nature and scope of its activities sees the whole vast field of public service as a unit in very many of its aspects. The ethical relation of one class of utility service to the public is exactly that of every other class. Aside from the technical distinctions between the nature of commodities served to the public, the problem of public relations is precisely the same for steam railroads as for telephone companies, though the services rendered are widely dissimilar.

Community of Utility Interests

Promptness, courtesy, adequacy, honest financing, efficiency, fair rates and charges,—are all terms equally applicable to the universal demands of ideal utility service. When the railroad fails to furnish sufficient cars to move stock, perishable agricultural products, or urgently needed merchandise, it breeds the same sort of wrath and distrust as when the telephone company through lack of a little foresight fails for months to extend service to the homes of the new suburb.

The community of interest between the various types of utilities is just recently beginning to be understood. This is reflected in joint conventions of divers utility interests. It would not be beyond logical deduction to prognosticate at some near future date a monster gathering together of all the railroad people—steam and electric, the gas and electric, heating and telephone concerns to deliberate on the great, vital fundamental principles of service common to all.

Public Relations—the Topic of the Hour

Recently I was immensely gratified to be present at and participate in a convention of the Great Lakes Division of the National Electric Light Association in session at French Lick, Ind. Four great central western states were represented in the organization. More than one-half of the time of that great convention was consumed in the discussion of public relations. From the tone of the addresses, strong, vigorous, optimistic, one might easily have gained the conviction, or im-

pression at least, that no increased return on investments, increase of salaries or any other advantage of the operators or employees was of nearly as much concern as the promotion and cultivation of altruistic aims and policies in their public utility service. This spirit was indeed a "far cry" from the plotting, in secret star chamber, of a board of directors chiefly concerned as to how it could best bilk the public by extorting from it as large a tribute as possible with as little service as might keep them out of jail. As a matter of fact utility men are not, and could not be if they would, the purveyors of charitable benevolences. They are simply applying square deal business ethics and sagacity. That is all an informed public ever wants and is all that it has a right to expect and it is willing to pay a fair price for it.

What State Committees Are Doing

In each of the four states of the Great Lakes Division of the National Electric Light Association the electric, gas and telephone interests have united in establishing a central bureau of publicity. These bureaus are in charge of experienced publicity men—usually newspaper men of wide experience who have also sufficient technical knowledge to enable them to select with discrimination the information that is to be conveyed effectively to the people. Public criticism, especially newspaper criticism, of defects and breakdowns in service, or of rates, is broadcasted with almost the same fidelity as is commendation of satisfactory conditions. The newspapers have gladly published all items and articles intended to instruct and inform the people. Misinformation or mere colorful propaganda or anything less than the whole truth is abjured. Praise or blame of the state commission's actions receive the same impartial treatment as mere news. So conducted, I think these agencies calculated to elicit the confidence and cooperation of the people by disseminating knowledge are of distinct, pronounced value. Of course, no publicity and no advertising, however skillfully and widely done, can permanently sell shoddy goods. The goods themselves are their own best advertisement.

The utility business is the business of the public to a larger degree than any private enterprise can be. The private merchant may buy secretly at some bargain sale, mark the cost price and selling price on a little card in certain mysterious hieroglyphics, and actually disregard even these supposed guides to good profits when he makes a sale. The silk he sells may be only highly mercerized cotton and the woolen coat may be cleverly doctored, reworked, second-hand goods.

The Public Must Be Told

The utility man must play his game in in the open beneath the pitiless glare of full publicity. The securities he issues and sells, the interest he pays, the rates he collects, the kind of material he uses above or below ground, every act of his board of directors, are all open to the public if it will take the trouble to look. If anything escapes the public notice the argus-eyed experts of the commissions will usually find the "colored gentleman in the fuel garage." And yet the technical character of the terminology of financing, of rate schedules, of construction and operating requirements, and of generation, manufacture and distribution, is such that the people find it difficult to understand. Men have always been distrustful and suspicious of the unknown, the mysterious, and this is especially true when it reaches into their pockets. How few people comprehend the ordinary primary and secondary charges of an elec-

tric light bill or the basis of a demand and energy charge on a power bill. I was impressed with this some years ago when a very great judge of our Supreme Court unqualifiedly condemned a form of rating and billing that he alleged was designed to keep the public in ignorance. I know that by skillful simplicity, even an apparently difficult rate form may, by means of advertising, be made intelligible to the mass of consumers.

During the war period it became necessary to reduce the B.t.u.'s of gas. The manner in which the various companies handled this job was interesting and instructive. The operator, with the instinct of a real business man and quasi-public servant, long before the reduction was made, trained and drilled everybody from the manager to the meter reader in the significance and meaning of the change. The required adjustment of consumers' equipment was made apparent to the public. Circulars and readable and attractive newspaper advertisements with opinions of experts, all assisted in preparing the way for a smooth transition from the use of richer to the leaner gas.

Other operators made the reductions very gradually and during the period of reduction used every reasonable means of publicity and personal visitation and assistance.

The Attitude That Breeds Complaint

In violent contrast to such sane methods other operators acted on the principle, or want of principle, of "making them like it"; told the people their burners were dirty and at any rate the railroad commission had ordered it and it was up to that body to explain its action. This favorite suggestion of the incompetent operator was seized with avidity by the consumers and you may well understand that the commission was well-nigh inundated by the virtual showers and cloudbursts of gas complaints. In the meantime the whole gas industry suffered from the incapacity of the misfit operator.

Much of the advertising and advertising advice I have seen relates to merchandising, to boasting of the magnitude of the industry, to increasing the sales and consumption, to marketing the securities of the company, to emphasizing the indispensability of the industry to municipal growth—to generally make the business loom large, beneficent and beautiful This is all splendid from the merchandising standpoint and tends to build up confidence in and appreciation of the company's business acumen and loyalty to the community. Even commissions often restrict their public statements, i.e., advertising—to their actions and adjudications which they know the people will approve and applaud.

We delight in telling people of the savings in rate reductions but we are quite generally on the defensive when we discuss for publication decisions in favor of utilities.

What Happens When Publicity Is Ignored

Some of the faults and defaults of utility management are such that the least said about them the better, but many of the mistakes, breakdowns, interruptions and annoyances that irritate the people and contribute to mass hostility could effectively be rendered innocuous by proper publicity.

Recently I chanced to occupy a sleeping car berth on a route through Indiana. It was an all night, rough rider performance. Bronco busting, I fancy, would be a mild pastime compared to the seismic-

like rockings and jolts of that leaping and bounding steel beast. It may have been that the load was too heavy with utility men and commissioners for the engine power. It may be the engineer had a special grudge against all humanity. Whatever the cause, it was needlessly unexplained and the passengers are still thinking the profane maledictions so explosively and shockingly jarring the poetic Indiana air during the night and the morning after. Recently, I alighted from a train in the train shed at Milwaukee. Hundreds of passengers including several feeble old ladies were compelled to climb over another train to reach the depot. There were numerous movable steps available and a small swarm of employes looking indifferently about while the passengers painfully dragged themselves and hand baggage over the obstructing train. No effort was made to explain or to part the train.

A railroad company, without notice, other than a bulletin inconspicuously placed in the station, abandoned the operation of a train. Hundreds of people in gala-day dress, families with dinner baskets, with gay expectations of a happy day at a country resort, were grievously disappointed. The very children will remember that common carrier with anything but sympathy.

A telephone company, through a well meant but inadvertent authorization of the commission ten years prior, suddenly and without notice, changed the classification of 'phones in churches from residence rates to business rates. Even pious preachers damned that action and their language sounded good to me.

Perhaps it will be more pleasant for all of us not to exemplify my point by similar episodes from gas company administration. The advertising should not neglect apologies for errors and blunders for which no honest alibi exists and the fullest possible, patient explanations of the problems and practices difficult and perplexing to the public and the defaults prima facie assignable to the utility but for which the utility is not seasonably responsible.

State Committees Admirably Conceived and Organized

From long experience permit me to say that I have unswerving faith in the final, ultimate fairness of the people when they are fairly treated and know the facts. The state committees, it seems to me, are admirably conceived and organized to furnish the expert service needed to build up such mutual knowledge and understanding between the producers and distributors of the utility services so closely essential, not only to the comfort and convenience of the people, but to the very existence of our modern social and business fabric. I am sure that the commissions welcome the activities of these committees and their bureaus as effective aids to the accomplishment of the common purpose of the utilities and the commissions to establish and maintain the highest class of service at the lowest reasonable cost.

B. J. Mullaney: The Publicity and Advertising Section is under great obligation to Mr. Gettle for his very interesting paper.

The president then introduced Hon. Dwight N. Lewis, who addressed the members, his subject being

THE ORDINARY CITIZEN

Hon. Dwight N. Lewis, Member of the Iowa Board of Railroad Commissioners, and President of the National Association of Railway and Utilities Commissioners.

When I was asked to address you gentlemen, I knew I had nothing particular to offer you. I would not want to undertake to tell you how to run your business. I know the fellow on the sidelines can always tell how the game should be played, and when you are on the sidelines of our football games, as we have them played now, no doubt you know exactly how the quarter-back should have called the play.

I do not want to be in the situation of the little boy who was drawing pictures in front of the fireplace and his fond Mamma said: "Well, Johnny, what are you drawing?" He said: "I am drawing a picture of God." "Well, but don't you know, Johnny," she said, very much shocked, "that people don't know how God looks?" "They will when I get through."

And so the relationship between public utility commissions and utility companies has not always been quite as tolerant as we might wish. Sometimes we have been inclined to be a little set in our ways, believing that the other fellow was wrong and we only were right. Just on my way here I heard a new definition of tolerance. It was a baseball game between the Ku Klux and the Knights of Columbus with a negro for umpire, the proceeds to go to the Jewish Welfare Fund. When we have reached that happy stage there will be no further need for discussion on public relations.

A great American, a great ordinary citizen, one who had driven a mule on the canal tow path, worked his way through college and later reached the presidency of our great republic, one who had led men in the Battle of Chickamauga, when the world was aghast at a terrible crime, when the fabric of our destiny as a nation had been battered and torn by the cruel hands of civil war, when the martyred peace-loving Lincoln had just breathed his last, this ordinary citizen, speaking to a heart-broken, vengeance-breathing, reason-bereft mob in New York, gave utterance to a truth we need sometimes to learn anew. James A. Garfield, raising his hand and voice in those perilous days, said: "The President is dead—but God is in His Heaven, and the government at Washington still lives."

Another of our great ordinary citizens, the late President Harding, whom we had, regardless of political affiliation, or personal view, learned to love and esteem, had the same great thoughts and expressed them many times. In a recent issue of the Public Service Magazine I find this quotation from a speech made by our lamented President Harding to the New York Chamber of Commerce, and it is so good I am passing it on to you.

"Our great assurance at home lies in a virile, intelligent, resolute people in a land unravaged by war, at enmity with no people, envying none, coveting nothing, seeking no territory, striving for no glories which do not become a righteous nation. This republic can not, will not fail if each of us does his part." That is the real heart of the ordinary citizen of America—I know it to be true of our own people of the great inland empire of the midwest, the corn-belt.

I do not know whether you feel that way about it or not after getting election returns. Sometimes I wonder whether our friends in the east would expect to see red flags floating everywhere if they got out there in our midwest just at this time, but I want to assure you that you need not be alarmed. We may make mistakes out there but at heart there is no more patriotic citizen or a citizen more certain to stand loyally by the Constitution of the United States, and no citizen on whom you can more assuredly depend than the great agricultural population of the midwest.

And he has that same lofty purpose in his heart respecting the home problems. He is imbued with the spirit, with the religious spirit, of fair play. He does not want to do injustice to the other fellow, neither will he tolerate being buncoed when he knows it. Of course a lot of fun is poked at our farmer folk for buying blue sky securities, and some of it is justified. But I do not know as we are any worse than some of our so-called financiers at that—Wall and Broad street lambs are sometimes sheared quite thoroughly by some smooth swindler from the provinces. At least, our folks tried to build packing houses right where we feed the tall corn to the wide hog, and tire factories in the locality where there are more automobiles per capita in use than anywhere else in the world.

It is the average American, the ordinary citizen, upon whom the fate of our country rests. If he fails, we go smashing to defeat: if he stands firm, then the gates of hell cannot shake our sure foundation.

Looking over the list of the strong men America has produced—from whence do they come? From the homes of affluence, of wealth, of ease, of long years of aristocratic aloofness from the common herd? They do not. They come from the farm, the workshop, the dingy office, the log cabin, the tow path, the paint shop, from every place where we find men and boys working out their salvation with the brain and brawn that God endowed them with. Lincoln thought God must love the common people because he made so many of them. Have you visualized that recent scene on a rock-strewn farm when a New England farmer, also a notary public, swore his son, "Cal," into the presidency of the United States at three a. m., by the light of an oil lamp—a farmer swearing in his farmer-boy son —God be praised that such things are still possible in this great land of the common man.

I had the pleasure of a recent visit with President Coolidge. I was for him before, but the simplicity of the man, the sincerity of him, is so impressed upon me that I am going back to the tall corn a strong supporter of President Coolidge.

I deplore, as I believe all true Americans must, the emphasis that is being put on so-called class distinctions. We have a cartoonist in my home town who delights the American people by his wonderful pictures of our weaknesses or

strength. In a recent cartoon Mr. Darling, or "Ding" as he is best known, showed Uncle Sam at the helm of a row boat, oarsman labeled "Farm Bloc," "Labor Bloc," "Capital Bloc;" and various other "blocs." Each was pulling his oar without regard to the others, and of course the boat was not only getting nowhere but was in danger of capsizing. Against this picture was another showing all pulling together, and there were songs in the air and speed and accuracy in the water, with Uncle Sam smiling his satisfaction. We must have it so—and it is the ordinary citizen who will bring it to pass. We must learn, as President Gompers of the American Federation of Labor has said out of his long and active experience, "that there is no magic in law." No man was ever made righteous by law, and no great economic question is ever settted by law. No more than are world questions settled by world wars. Great reforms have their seeding place and root growth in the hearts of the people. I have about reached the conclusion that the religious motive is the one that is necessary to produce a real and lasting reform. All men, whether they realize it or not, are at heart religious.

President Coolidge has never said anything better than: "It was because religion gave the people a new importance and a new glory that they demanded a new freedom and a new government. We cannot, in our generation, reject the cause and retain the result. If the institutions they adopted are to survive, if the government which they founded is to endure, it will be because the people continue to have similar religious beliefs. It is idle to discuss freedom and equality on any other basis. It is useless to expect substantial reforms from any other motive. They cannot be administered from without. They must come from within."

We have come back to work from our all too brief vacations in the woods, the mountains or beside the lake, where, when evening came, we sat beside the camp fire and watched its flames flicker, a tiny fork of fire here, a glowing coal there, and, as we watched the fire, we dreamed our dreams and thought of home, friends, perhaps even business. The open fire is a wonderful inspiration for dreams, and plans, and contentment. Small wonder that our ancestors were fire-worshippers. Our earliest history finds human beings cooking their food —and in spite of the raw food doctrines so assidiously propagated, doubtless we will continue to cook our food. Man was a helpless animal in the dark until he found he could make a fire. Of course, it is a long cry from the small brazier and clay ovens of the Assyrians to the gas range and oven of the present day, but here we are enjoying these modern blessings and knowing very little about any of them. The ordinary citizen is too busy making a living sufficient to send his kids to school and keep his "universal car" supplied with endless repairs, and its gormandizing appetite satisfied with gas.

George Washington lighted his home with candles and cooked his food in an open fireplace—and in the short span of our history we have seen the great evolution of lighting, and heating.

When I was invited by your great association to address you, I was, of course, delighted with the honor, but as one of our ordinary citizenry I had to acknowledge that about all I knew about the gas industry was my monthly bill from the Des Moines Gas Company. Let me say right here, that in the 25

years I have been a patron of our local gas company, I do not believe I have had occasion to register a legitimate complaint as to rate or service—on the contrary, I have always found the management and employees courteous and ready to go "the second mile." I remember that Des Moines made herself known in the famous Des Moines gas case, one of the leading cases in public utility legal adjustments, but I am giving you my personal experience. I have known nothing of the economic aspects of the gas industry. Our commission is one of those few that do not have jurisdiction over gas-supplying utility companies.

At a ministerial meeting the presiding preacher announced that a brother minister at the next meeting would have a paper on the devil and he wanted no one to miss it, for it would be a wonderful paper, because the brother was so full of the subject.

We have some recent additions from the midwest to the legislative halls of our country, who ought, for the same reason, to be good speakers on the gas question, but I doubt whether their utterances would be more illuminating than mine, though perhaps greater heat producers.

I remember myself when electricity was on trial as an illuminant, and gas the prevailing and more satisfactory method. Then came improved electric lighting with the filament light, and gas, in a frantic effort to save itself as an illuminant, blazed forth through the Welsbach burner—and never will we have a more satisfying light for the eyes. But the fight was an unequal one and electricity as an illuminant took the top place. And then I wondered if the days of manufactured gas were done. One day I expressed myself in some such fashion and a friend of mine, who knew something of the gas industry, laughed at my self-confessed ignorance. Being one of those ordinary citizens who like to know, I looked up some statistics on the gas question. I found something to amaze me: that gas companies could scarcely keep pace with the demand for the product, that while in 1901, the annual consumption of gas was 101,625,366,000 cubic feet, in twenty years it had increased more than 300 per cent or to 326,000,000,000 cubic feet—and right at the time I thought electricity was driving it out of the market.

Eight million and more perhaps of gas cooking appliances are now in use. Every home that can possibly get the service insists on gas for cooking and water heating and for room heating, too. In my home town gas mains to new residential sections are constantly being laid and new great storage tanks have been erected—great landmarks of a city's increasing prosperity. I understand that the gas industry is adding to its list of customers about 350,000 per year.

I learned something of the wonderful processes of gas production, of the numberless by-products of the black ooze that has blessed mankind—some of course "not so good"—and that over $4,000,000,000 are now invested in the plants and equipments of gas-supplying utility companies. Whose billions are these? Not yours—certainly not mine. Thousands of investors, large and small, have risked their savings in gas company securities and stock—insurance companies hold the bonds representing still other thousands of investors. I am a believer in public ownership of public utilities, not government ownership. Additional capital must be con-

stantly secured to develop the industry and it should come from the customer, the consuming public. Many millions of dollars are needed in your industry this year to carry out the building program.

May I digress here for a moment to register my protest, feeble though it may be, to the tax-exempt security. I do not believe the ordinary citizen realizes how much heavier his annual burden of living expense is because cities, towns, school districts, etc., are issuing tax-exempt bonds for the building and extension of sewers, new roads, school buildings and various other political necessities. But railroad companies, street car companies, electric light and power companies, and gas companies must go into the money markets and pay well for the money absolutely essential for the production of such service as the public needs require. The consumer must pay the bill, for the charge for the use of capital is part of the cost of production. The ordinary citizen must somewhere, sometime, learn that one cannot have his cake and eat it, too.

Some day he will wake up to the fact that we have wrongfully created and are now creating a wealthy tax-exempt class which is not sharing in the public burdens and he will arise in his righteous wrath and smite this unclean thing, if necessary by constitutional amendment. It is the patriotic duty of every country loving citizen to do what he can to at least gradually bring about the abolition of tax-exempt securities.

I live in a town noted for its sooty veneer, where the black speck of smudge on the nose is a sure sign of citizenship, where the soft coal smoke and sulphurous fumes so surcharge the air in winter as to stifle and choke when the wind is just right. What a wonderful thing it would be if we could find a way to heat our homes and offices and stores, and supply our factory fuel by the use of gas. Someone has said smoke does $10,000,000 worth of damage per year in Pittsburgh, almost as much as the annual coal bill for domestic use in that city. Surveys have been made indicating the real economy that would result from the general use of gas as fuel.

As an ordinary citizen I am interested in economy—I have to practice it whether I want to or not. If it can be made to appear that there is real economy in the use of gas for fuel, we will demand its use. We may put up with dirt, and smoke and ashes and sulphur fumes if we think we live cheaper by doing things that way, but if it can be shown us it is cheaper to use gas, we sure will want it and be glad to have the cleanliness and comfort of its use as a side line. It would be wonderful to have smokeless cities—I would like to live in one. Our coal and oil supply is not inexhaustible, although I suppose we need not lie awake nights worrying about it. We must think and plan for the future, however, even though we know so little of what tremendous changes in all our plans and policies may take place within the next few years. We did not dream twenty years ago that it was possible that self-propelled vehicles on the public highways would be threatening the continued operation and life of the short line railroad and the short haul traffic of the country, yet here it is and it presents a problem in transportation that is demanding our best thought for its proper solution.

At the American Railway Association meeting last week held on Youngs Pier, I was told that three years ago where the truck exhibit required two

per cent of the space used for exhibits, this year more than twenty per cent of the space was so occupied, indeed nearly one-fourth of the space, beside a number of cars being demonstrated outside.

As a common citizen I learned how dependent we were on gas for cooking when an unfortunate accident put the gas plant out of commission. There were frantic rushings to and fro to secure oil stoves, gasoline stoves, anything; and hotels, bakeries, restaurants were helpless to feed the people. We were told, by whom I have never found out, that it might be weeks or months before we could again obtain our beloved gas for household use—but I had scarcely got the oil stove going good before the gas service was restored. I found that every effort possible was put forth by the management to repair the wrecked plant, day and night work by an army of employees, so that the least possible inconvenience would result from the explosion that had wrecked the plant. As a citizen I was impressed by the resourcefulness of the company and the energy displayed in restoring service.

I found upon investigation that gas was the first public utility. That a crude process for its manufacture was discovered about the middle of the 17th century but that it did not become a usable reality until late in the 18th century. It even then preceded electricity, the telephone, and the electric and steam railway. What wonderful civilizing agents these common utilities have become, and how much we take them all for granted.

The first gas company was granted a charter in England by King George the Third in 1812. Sir Walter Scott said it was the dream of a madman and the great Napoleon dismissed the report of the wonders of the new invention with a sneer. It is said that William Murdock, who in 1792 really discovered the process of distilling gas from coal, was believed to be in league with the devil because he went about at night swinging a queer lantern burning something that came out of a bladder. He had a devil and the people feared him. We have not overcome that fear entirely yet. There are just a lot of us ordinary folk who still believe the devil to be largely concerned in the operation of and management of gas companies—other public utility companies, too. Strange how old superstitions will persist!

As an ordinary citizen I have been led to believe that all public utilities are seeking to prey upon the public: that instead of being organized to serve me, their sole and only purpose is to exploit me, grossly overcharge me, and bind the whole community into abject slavery—of course the utility companies might provide gas or electricity, or street cars, but their main purpose is to rob the public.

We have listened to the siren voice of the man who wanted votes and some of us believed him. Of course if I would but stop to think I would know that this was largely bunk, but I am busy making a living and I have only heard one side of the story.

You know the radical sometimes gets on our nerves, but after all he is not such a detriment to public welfare. He calls attention in an exaggerated way to conditions that may readily be remedied by the sober, safe, ordinary citizen who is always finally in the majority. Radical notions today may be quite respectably conservative to-

morrow. Neither is the reactionary to be altogether despised. We get very impatient with him as he clogs the wheels of progress. He is like the tortoise.

"Say waiter," said the hungry guest who has given his order a half hour before, "did you ever visit the zoo?" "No sir," replied the waiter. "Well, you ought to," said the guest, "you would enjoy watching the turtles whiz past you."

If our reactionary acts as a drag on progress, he is also an anchor that will keep the Ship of State in harbor when destructive storms are howling in the open seas, and the radical skipper insists on seeing what would happen to the old tub if they did get it out there. New York last winter undertook to legislate the value of gas by fixing the price at $1.00. You know the story, which is as yet unfinished.

Foolish restrictive legislation, from which about the only protection invested capital has are the federal courts, is often attempted and too frequently passed. And some of us ordinary citizens are kicking on the so-called usurped powers of the judiciary.

The ordinary citizen does not understand how gas prices are fixed, nor why. What are you doing to educate him? Recent statistics indicate that there are about 10,000,000 people in the United States who can neither read nor write—and yet millions of these are using gas and go to the polls and vote. How? As they are told by someone in whom they have confidence. As a customer I would like to know about gas, how it is made, and why does it cost me $1.25 per thousand or $1.50 or whatever it may be,—maybe I would like to be invited to inspect the plant some day,—I would like to know what you mean by B.t.u.'s and water gas and coal gas—and why is a lessened candle power and increased heat power better for my use.

Advertising is good, but the spoken word is better. A man likes to know the man he is dealing with, not at long range but across the counter. The written or printed word was a great incentive to sacrifice and patriotism during the great war, but the tens of thousands of brief messages, the spoken word, in church, theatre, school, market place, and forum, wrought the soul until it poured itself in sacrificial offering.

We are all laborers together in the work of the world. Some of us may have a little money to invest too—but we must all work, and work together for the common purpose of universal peace and prosperity, else we have economic chaos, anarchy and ruin. As an ordinary citizen I want the gas company or other utility companies to prosper, to prosper so much that not only may I use gas in my home for cooking, and water heating, but for heating the home: I want the company to prosper so that I may have service, real service.

We hear a great deal about service. Church pulpits are ringing with it—public officials are talking it, great conventions like this are stressing it. Why? We have learned that genuine unselfish service is the greatest thing in the world—that it is the visible expression of that spiritual quality that Paul expressed when he said, "Then abide faith, hope, and love, these three, but the greatest of these is love." We cannot have too much of the spirit of service, genuine, honest, sincere desire to do our best for the other fellow.

When I pay and whatever I pay, I want and have a right to expect good

service. I want good gas, and when I go to the window to pay my bill I like to be treated as though my three or four dollars per month were quite important to the company, and that I am personally quite essential to the continued happiness of the gas company. That is the way you like to be treated too. If I have a little complaint to make, it almost makes me wish I had not said anything about it, to have the gas folks so concerned over my troubles. And the cheerful repair man comes promptly, fixes the trouble and says, "Well, while I'm here I'll just look over the whole thing. Might find something else that needs adjustment." Will I be a booster for the company? I'll say I will. The company that waits a week to send a trouble man to see what ails a gas range that is not giving satisfaction to the cook, has not cinched a friend but has made a dissatisfied customer. Multiply that a few hundred times and you have a sentiment, and sentiment crystallizes rapidly into conviction, and then the trouble begins.

I had thought to say something on the question of valuation, and the difficulties of the ordinary citizen understanding what it is all about. I have some thoughts on government or municipal ownership which are not very favorable: on state regulation versus local control which are not complimentary to the latter; on public relations from the commission point of view, but the representatives of state commissions, members of our National Association, are to address you on these and other important subjects and I forbear.

I feel that in a sense I am here representing the state utility commissioners as the president of their association. I would not have you think, however, that I could voice their composite sentiments on all questions. I do know, however, that I voice their honest and sincere desire to deal justly and fairly with the troublesome questions as they come before them for solution.

Our late president seems to have chosen for his life text from the Book of Books that expression of the prophet Micah, as found in chapter six, verse eight. "What doth Jehovah require of thee but to do justly and to love kindness and to walk humbly with thy God." This is a good text for public service commissions and public utility companies too. Mistakes we shall make, but they shall be mistakes made in an honest effort to serve. You have your duties to discharge for the benefit of your security holders and other investors, as well as to the public, the consumers. It is not always easy to know just the right thing to do, but honesty and sincerity of purpose will lead into the light sooner or later.

In the July number of your association Monthly, in an article by Mr. Mullaney of the Peoples Gas Light and Coke Company of Chicago, I find this significant statement:

"Speaking in round figures, the population of the United States has increased about forty per cent in twenty years. During the same period demand for and use for street railway service has increased 166 per cent; use of gas service has increased 207 per cent; use of telephone service has increased 1,000 per cent; use of electric light and power service has increased 2,000 per cent. The electric light and power company in Chicago has more customers (630,000) than there were users of electricity in the entire country twenty years ago.

"What is the obvious conclusion?

Only one is possible. The organized community life of today, commercially, industrially, and socially, is built around these public utility services. As they function efficiently or inefficiently, so the community functions efficiently or inefficiently and becomes attractive or unattractive to new enterprises and new population.

"These services function best when there is mutual understanding and good will between them and the communities they serve. Questions that might tend to disturb those relations, of which rates and service regulations or restrictions are the commonest examples, are not questions to be settled on the basis of a horse trade. They are best settled on the basis of community interest in its broadest sense."

With those sentiments, I am most heartily in accord.

And so I close, wishing for you and the interests you represent, continued progress and prosperity, until every city shall be smokeless, until every housewife knows the joy of the use of gas, until that day, when the troublesome demagogue is done with his warwhoop, and the weary gas manager may lie down to rest without fear of nightmare or a worse awakening.

The President: Mr. Lewis, on behalf of the American Gas Association I want to thank you for your very interesting and inspiring talk. He starts out, gentlemen, by telling us that he does not know anything about the gas business, and then he very shrewdly touches upon so many of our troubles and in such a way as to show his insight into what those troubles really mean. I think he would make a pretty good gas man himself.

The president then introduced Hon. Carl D. Jackson, who addressed the members, his subject being

THE RIGHT TO PERFORM PUBLIC SERVICE

HON. CARL D. JACKSON, General Counsel, American Gas Association.

MR. PRESIDENT and gentlemen of the American Gas Association, if you will bear with me a few moments I will just try to call your attention to two or three aspects of the present situation.

I am going to ask your attention to one or two fundamentals in connection with the system of regulation, partially from a legal point of view, because if some of those principles are understood thoroughly I believe they have an important bearing upon the welfare of the gas utilities. In the first place, the courts are beginning to recognize and declare the patent fact that though your property is devoted to a public use it is still private property subject to private management and not subject to governmental management.

In this connection I want to then go to this point: that the question of how far regulation itself may go is still an important matter to be watched and determined upon strict legal principles. The matter is well expressed by Mr. Bruce Wyman in the preface to his work entitled "Public Service Corporations." After calling attention to the fortunate fact that state regulation of public service companies is now almost universally accepted, he points out that two ways can be found for the exercise of that control, one through regulation and one through government ownership. He then goes on to say:

"As time goes on, I am finding myself almost among the conservatives in standing by the original program for state control. It is still my belief that the State should as far as possible confine itself to regulation, leaving the companies to work out their problems of management. State control need seldom go further than regulation in this sense. Whatever the companies may do should be subject to immediate revision by the constituted authorities. There should be swift reparation provided for any individual who has suffered harm in the meantime, and that should be the full extent of governmental regulation, generally speaking. When the State goes further and attempts to dictate as to the policies which the companies shall adopt, it usually goes too far. Legislation going to this extent really crosses the line which divides state control from state operation. The next step would be government ownership with its unknowable consequences. * * This does not mean that everything shall be left to the discretion of the companies, as the conservatives claim. Discretion should be left to the companies, but it should be made clear that this discretion may be abused."

Now the rights which are established under regulation are the rights of providing for reasonable and non-discriminatory rates. Of course, that is so trite that you may wonder why I call your attention to it.

I am trying to bring forth here the thought that there may be unreasonable interference with public utility operation, and that that unreasonable interference

may be expressed in two ways, either by unreasonable or too intensive regulatory supervision by commissions, which I want to say to Mr. Lewis I do not think has at all eventuated up to this time, but it may—and this is the more important aspect which I wish shortly to call your attention to—be done through statutory interference directly by the legislature itself.

But just in regard to regulation itself, this one principle, that regulation is established for the purpose of bringing about reasonable and non-discriminatory rates—Mr. Nathaniel T. Guernsey, counsel for the American Telephone & Telegraph Company, in an address before the American Bar Association, has clearly pointed out the functions of a commission in relation to rate making. He stresses the fact that there is a widespread misconception as to where the commission laws of the various states leave the power to make the rates to be charged by public utilities, a misconception often found among officials and lawyers dealing with these matters. He says:

"The commission laws in general leave in the utilities substantially the same rate-making powers which they had at the common law; that is, they leave in the utilities the primary power to make their rates subject to the rule covering them at common law and reenacted in the statutes that their rates shall be just and reasonable and not discriminatory. Under these statutes authority on the part of commissions over specific rates is limited. It does not arise until it has been made to appear that the utility in its rate making has overstepped the just and reasonable or indiscriminatory rule established by the statute. In such cases, but only in such cases, the commissions are vested with authority to make the rates which will put the utility back within the rule established by law."

These are exactly the direct decisions of the Supreme Court of the United States in regard to the Interstate Commerce Commission law. It has been affirmed in several of the Supreme Court of the United States decisions and unquestioned as to that law. Mr. Guernsey then goes ahead to examine the laws of the various states in his address to the American Bar Association, and concludes that they are founded on the same principles in this regard that the Interstate Commerce Act is founded upon, and that the right to interfere by regulatory bodies is only that same right in principle which the Supreme Court of the United States has held applies to the Interstate Commerce Act.

Now, that might not look at first to be very important, but I think it is important and I think that Mr. Guernsey's calling attention to it is timely and proper. If the rule is as he states, and you have the power left on your part to file rates with a regulatory body which shall be reasonable, the right of a railroad commission or utility commission to interfere with your act in establishing those rates can only take place where it is clearly established by evidence that the rate which you have established is unreasonable.

If, on the other hand, the power of making rates initially is with the commissions themselves and they are the entire authority, both in initiation and otherwise, perhaps a different principle is established. This can be clearly shown if Mr. Guernsey is correct, and I think he certainly is, that if the rate-making power and initiatory power is entirely with the regulatory commission, that power may be exercised by the commission in any degree it sees fit, so long as it merely avoids confiscation. If, on the other hand, the power for rate-mak-

ing is in the utility, still subject to interference by a state commission only in those cases where unreasonableness can be demonstrated, then the power of the utility commission is not confined to the question of confiscation but the rights for reasonable rates, and reasonable rates to be decided initially by the utility itself remains in the utility, and the standard of merely avoiding confiscation is done away with.

It is not so much in relation to the regulatory functions, I am happy to state, and the excessive interference in regard to operation in connection with commissions, which I wish to speak about. In general, the commissions have entirely avoided this aspect of the question and are unquestionably intending to avoid it now. I want now to take up the other phase of the matter if I may take your attention for a few minutes and speak of that interference by the legislature in those cases where it has already established a regulatory body.

This is the second point and on this point I wish to say that we have in different states laws restricting the regulatory capacity of commissions and arbitrarily fixing by legislative act conditions and rates directly against the public welfare.

Some of these acts directly affect the gas industry in various parts of the country, and in some instances are of direct concern to the gas industry throughout the United States.

To refer first to the Transportation Act—the act under which the carriers were returned to private control and operation. The act was passed at the time when Congress was in the habit of providing minute regulatory supervision over all kinds of business necessary for the prosecution of the war. This act contains a provision believed by most people to be impracticable and impossible of enforcement if the public welfare is to be considered. I refer to that specific portion of the act relating to depreciation.

The act provides (section 20, paragraph 5) that the Interstate Commerce Commission shall prescribe for carriers subject to the act the classes of property for which depreciation charges may properly be included under operating expenses and the percentages of depreciation which shall be charged with respect to each of such classes of property, and the carriers shall not charge to operating expenses any depreciation charges on classes of property other than those prescribed by the commission or charge with respect to any class of property a percentage of depreciation other than prescribed by the commission.

This provision relates to carriers. You are not a carrier. Telephones are carriers; telegraph companies are carriers under that act, but carriers do operate every kind of public utility property and the classification of accounts covers every class of electrical equipment and gas property, and the question of depreciation in so far as it shall be fixed by the Interstate Commerce Commission under the provisions of this act, relates to gas plants and is now before the Interstate Commerce Commission. Fundamentally, the act is at fault. It provides or is being construed as providing that the Interstate Commerce Commission shall fix percentage rates, depreciation for all classes and units of property, all fixed capital accounts to be taken care of through separate reserves and mandatory provisions be made for the charge to your operating expenses of a fixed amount each month each year, regardless of financial or operating conditions.

This is a prime example of assuming to do everything by law, a prime example of the theory of intensive regulation amounting to the substitution of managerial functions for regulatory functions. It is aimed, at least as interpreted, to impose unnecessary financial burdens upon utilities and to interfere with the financial structure. It may, in many instances, adversely affect public utility credit.

State statutes interfering with the proper performance of public utility service may be found in a considerable number in various states of this Union. A perfect example of laws without excuse for being will be found in Chapters 898 and 899 passed by the recent legislature of New York. One refers solely to the City of New York and provides that gas companies shall not charge or receive for gas furnished or sold in the City of New York a sum for 1,000 cubic feet in excess of one dollar, nor furnish in such city gas of a standard of less than 650 B.t.u. per cubic foot.

This act was passed under political pressure. It did not pretend to represent matured judicial judgment of the legislature after competent investigation. It was passed in the face of the fact that in all human probability the act would not become effective but would at once be suspended by the United States Courts. Such an act was passed for the purpose of injuring the Consolidated Gas Company of New York in its performance of public service.

The standards for B.t.u. throughout the United States have been changed or modified by almost all of the commissions in the United States in the last ten years. It was finally recognized that the only outcome of unreasonable standards for gas service was to increase the cost of that service to the consuming public. Had this act for B.t.u. standards in the City of New York become effective, it necessarily meant a very large additional financial burden which must, of course, be ultimately paid by the consumer, and under any circumstances was interfering with reasonable service to the public and directly interfering with the possibility of performing the best service in the City of New York.

This was local in its application. At the very time this act was passed applicable to the City of New York the Colorado Commission did away entirely with the B.t.u. standards in the state of Colorado and left initially the fixing of the standard for B.t.u.'s to each gas plant in each community, it being authorized to fix what was most economic for the public welfare. That standard once being fixed by them, however, they provided for the most rigid rules for service and for the service being up to the highest standard under the B.t.u.'s which they finally selected.

This first New York act will not be taken seriously anywhere in the country, I believe.

The other New York act, referred to, established a precedent of the most unfortunate kind. Your organization for years has been endeavoring to get away from a form of rate schedule making it impossible to expand or render service which the public has a right to require and insist upon. The right to perform public service includes the right to render that service in the most economical manner and to meet the possibilities of service wherever possible. Such right can only be exercised under that form of rate schedule which will within reason and as near as practicable meet the cost of the service rendered to the dif-

ferent classes of consumers and the individual cost incurred in the rendering of that service. This act provides that every gas company shall charge for gas supplied a fair and reasonable price and to this part of the act there could be no objection. The act then provides that no such company shall make or impose an additional charge or fee for service or for the installation of apparatus or the use of apparatus installed. The act is entitled "Service Charge Prohibited."

If the act shall be construed as prohibiting any form of rate schedule which does not contain the entire charge in the thousand feet output part of said schedule, it passed an act directed at the possibility of the full performance of public service by gas companies in the State of New York. If this is the construction of the act, the legislature passed an act discouraging the use of gas and penalizing the users of large quantities of gas; discriminating in favor of those who take very small quantities or practically no gas at all, and discouraging all of those who wish to use gas to the fullest extent; an act increasing the cost of service and discouraging the possibility of decreased cost of service. Such acts as these necessarily prevent the full performance of public service by public utility companies.

This Association is well aware of the restrictive influence on service of old flat rate forms of schedule. The costs of service are known or readily ascertainable. The use of gas is increasing in a very encouraging way. The possibility for further development is unquestionably at hand, but the one thing necessary for such development is a sufficiently flexible system of rates to meet the requirements and costs of service to all classes of consumers, large or small. The acceptance of a flat rate, no matter how remunerative within the field served, must necessarily restrict the development of large volume consumption, the chief opportunity for growth and development of the industry.

The service charge aims to distribute the burden of service in accordance with the cost to the individual, do away with the old flat rate discrimination and to encourage the full use of gas among domestic consumers. It is a popular fallacy to regard the small consumer as a person of small income, in other words, the poor man. Surveys have now been made in several cities tending to show that the fact is to the contrary. In general, the survey shows that it is the working man who is being penalized by the flat rate and the small apartment or convenience user who receives the benefit of the discrimination. Antagonism to the service charge has been possible, I believe, in many instances, because there has not been made a sufficiently clear and simple exposition of what that charge is and what it is for.

The demand and output schedule especially for the larger consumer is the most fair and equitable rate possible. It is merely the application to the gas industry of principles long since accepted for all other forms of utility service. The power to adequately render service in the future to the full measure of economic use is dependent upon an equitable and flexible system of rates. The three-part analysis furnishes the basis for such rate structure.

There is, however, the burden on the industry of overcoming forms of rate schedule installed years ago when the possibility of gas service was not at all understood. The burden of bringing about proper forms of rate schedule to

meet in a practical way the situation throughout the country is such that the inertia of the old situation cannot at once be overcome. It is, therefore, most important that no backward step in this respect is taken anywhere in the country, as a backward step in one place is discouraging elsewhere. The excuse of expediency, while it may at times have a practical value, can be much over-emphasized, and there should be a resolution on our part not to give in to expediency but to insist upon what we know is right until it shall receive universal acceptance.

The President: Mr. Jackson, on behalf of the Association, I wish to thank you for your very interesting discussion. We hear a great deal and perhaps we cannot hear too much about our obligations to give service, but with those obligations there must be, as you have ably stated, the right to give service, the right to have the ability to give service.

The president announced that this concluded the business of the first General Session, following which the Executive Session would be held.

EXECUTIVE SESSION

Tuesday noon, October 16, 1923.

(Only company member delegates attending.)

The meeting was called to order by the president, the first order of business being the election of company members.

Election of Company Members

(Upon motion, seconded and carried, the report on membership, as relating to applications for company membership, was received and the secretary-manager thereupon cast one ballot for the election of company members whose applications had been approved by the Executive Board.)

Election of Directors

(The report of the nominating committee relating to the recommendations for directors was presented and on motion, seconded and carried, the report was received, and the secretary-manager thereupon cast one ballot for the election of the directors as nominated.)

1924 Nominating Committee

The President: The constitution provides for the election of a nominating committee at the executive session of this association. In the past and merely for the purpose of simplifying the procedure, it has been the practice to suggest the personnel of such a committee for the action of the executive session. We are prepared to make such a suggestion of personnel today but it is entirely within the province of the delegates attending this executive session to make their own selections and to elect such a nominating committee by independent ballot if they so desire. Printed ballots are at hand if the delegates wish this procedure carried out.

(Motion regularly made, seconded and carried that the chair offer the suggestions as to personnel for nominating committee.)

The President: The following names suggested are presented after consideration by the executive board with the special desire to have the various sections of the country adequately represented and also to have the various interests in different parts of the country properly represented:

Harry A. Norton, Boston, Mass.
E. H. Kiefer, San Antonio, Texas.
A. P. Post, Philadelphia, Pa.
F. W. Seymour, Battle Creek, Mich.
A. B. Macbeth, Los Angeles, Calif.
R. G. Griswold, New York, N. Y.

This committee on nominations is to be elected to present the nominations for the officers and directors for the year 1924-1925, and they will make their report at the 1924 convention.

(Upon motion, seconded and carried, the six members whose names were suggested were duly elected as the 1924 nominating committee.)

Committee on Resolutions

The president stated that for the same reason as given in the case of the nominating committee the same procedure would be followed in suggesting names for the committee on resolutions, as follows:

R. M. SEARLE, Rochester, N. Y.
C. N. STANNARD, Denver, Colo.
H. D. WHITCOMB, Newark, N. J.
A. B. TENNEY, Boston, Mass.
D. J. YOUNG, Tacoma, Wash.

(Upon motion, seconded and carried, the five members whose names were suggested were duly elected as the committee on resolutions.)

SECOND SESSION

Wednesday morning, October 17, 1923.

REPORT OF ACCIDENT PREVENTION COMMITTEE

F. W. Fisher, *Chairman,* Rochester, N. Y.

FOREWORD

The Accident Prevention Committee of the American Gas Association takes pleasure in submitting the following report of its activities for the fiscal year.

The Committee recognizes with appreciation the growing interest throughout the industry in Accident Prevention. Fortunately, Accident Prevention is becoming more generally recognized as a necessary part of operation and to this end the Committee believes that its work during the past year is a distinct contribution. We gratefully acknowledge the support we have received, especially the whole hearted cooperation of the Headquarters Staff.

First Aid and Resuscitation in Gas Asphyxiation

(See Detail Report No. 1)

The Association's Commission on Resuscitation, as a part of its labors, has contributed a booklet on "First Aid and Resuscitation in Gas Asphyxiation" which has received the approval of the Committee and has been printed and widely distributed by Headquarters. This booklet forms an appendix to this report and by virtue of its clean-cut presentation of the latest scientific information along these lines will unquestionably prove of great usefulness to the Association's membership.

In connection with the use of this booklet it is impossible to overemphasize the importance of systematic training of all employees in the prone pressure method of resuscitation and the providing of thoroughly trained operators of the oxygen carbon-dioxide inhalators.

Final Report of Resuscitation Commission

(See Detail Report No. 2)

The Resuscitation Commission has also submitted to the Committee its Final Report on Resuscitation, which is presented herein in full as an appendix to this report. This report of the Commission in the judgment of the Committee, disposes of the past lack of authentic information in connection with artificial resuscitation. The report emphatically approves of the Prone Pressure Method. The Committee believes that this work together with the development of the Carbon-dioxide Method, is of signal importance not only to the Gas Industry, but to the Public generally.

Revision National Electric Light Association's Rules for Resuscitation from Electrical Shock

In connection with the work of the Resuscitation Commission, this Committee was able to utilize the Commission's services to assist the National Electric Light Association in the revision of the latter's booklet on Artificial Respiration, by having the same reviewed by the Commission representing the Gas Association. This service will result in material benefit to the Association's member companies which do an electric business, inasmuch as one standard method of resuscitation, (namely the Prone Pressure Method on victims of electrical shock, gas poisoning and drowning, who are not breathing) has been adopted.

Wireless Broadcasting of Prone Pressure Method of Resuscitation

(See Detail Report No. 3)

With further reference to the Prone Pressure Method of Resuscitation, this Committee was helpful in securing the joint approval of the American Gas Association, The National Electric Light Association and the National Safety Council of a message on resuscitation, which was broadcasted from the major wireless installations of the Country. This message appears as an appendix to this report and is recommended for its accuracy, brevity and simplicity.

Addicks Medal

(See Detail Report No. 4)

It is with great satisfaction that the Committee is able to report that a member of the Association whose interest in Accident Prevention work is in keeping with his great ability as an administrator has upon the suggestion of the Committee donated a medal to be known as "The American Gas Association's Meritorious Service Medal," to be awarded under reasonable conditions for the saving of life by employees of member companies of the Association. Mr. Walter A. Addicks, Vice-President of the Consolidated Gas Company of New York City in thus presenting to the Association a service medal of original and striking value, has contributed in no small measure to the progress of Accident Prevention. The communication from Mr. Addicks together with the conditions governing the award of this medal appear as an appendix to this report.

Statistics on Gas Asphyxiation

(See Detail Report No. 5)

The Committee has had in mind that the industry has received from time to time some unfavorable notoriety with reference to asphyxiation by gas in connection with its use. Through a special Sub-Committee, it has collected certain statistics which are submitted as an appendix to this report and which prove almost conclusively that much of the notoriety mentioned is unfair and that the detractive inferences made against the use of gas are unfounded. It has come to the attention of the Committee that organizations interested in Public Safety contemplate research and recommendations covering gas asphyxiation accidents. It is true that there are many fatal asphyxiations nearly all of which are suicides. The comparatively few real accidents, however, do justify a proper investigation of this subject, particularly with a view of the use of improperly designed or installed appliances. The Committee feels that such an investigation properly belongs to this industry from which competent men must necessarily be selected if the best results are to be obtained.

The Committee therefore recommends that its successor make this subject a special order of business for the coming year and also recommends that the suc-

cessor committees keep in proper and close touch with the several organizations interested in public safety referred to, and secure their cooperation so that the final finding will not only cover gas manufacture and distribution in so far as these concern asphyxiation accidents, but will also present the viewpoint of those having a general interest in the Safety of the Public.

Coordination of Public Utility Safety Work

(See Detail Report No. 6)

It has been felt among some of those most interested in Accident Prevention work, that a better coordination of the safety work of Public Utility Organizations was desirable and steps toward the formation of a suitable committee were taken early in the year by the appointment of representatives from the Accident Prevention Committee of the American Gas Association on an advisory board to be made up of representatives of the National Safety Council, National Electric Light Association, American Gas Association, American Electric Railway Association and the American Telephone and Telegraph Company. This board has not yet been organized, but the Accident Prevention Committee of the American Gas Association stands ready to assist in its organization and operation. The committee recommends that its successor endeavor to secure action on this matter.

Organization of Accident Prevention Committee

(See Detail Report No. 7)

The extent of the Accident Prevention Committee's business has shown the advisability of the formation of a definite organization and the same is submitted as an appendix to this report for the guidance of future committees, in the hope that the experience of the present Committee in organizing and routing its work will be helpful to its successor.

Publicity

In connection with the work which the Accident Prevention Committee has done and may be able to do, the need for more widespread publicity is urgent and it is, therefore, recommended that suitable arrangements be made at Headquarters to handle desirable publicity on Resuscitation, Education, Statistical Information on Gas Hazards etc., as an established routine so that the publicity may be effective and continuous.

In this connection the Committee has in progress the preparation of "Bulletins on Catastrophies," based upon information submitted by member companies which have recently experienced serious personal and property accidents.

Conclusion

The Committee recognizes that concerning the vital parts of its completed work, namely, the First Aid Booklet and the report of the Resuscitation Commission begun under the auspices of this Committee's predecessor, it has had only a limited participation and that recognition is due the eminent physiologists of the Resuscitation Commission for the splendid and gratuitous service rendered to the industry and to society.

Report No. 1

FIRST AID
AND
RESUSCITATION
IN
GAS ASPHYXIATION

AMERICAN GAS ASSOCIATION

1923

REMEMBER THAT WE ARE HERE CONSIDERING THE SAVING OF HUMAN LIFE, AND THAT YOU MAY BE THE NEXT VICTIM WHO WILL NEED HELP. THEREFORE IT IS YOUR DUTY AS A MAN AND AN EMPLOYEE IN THIS INDUSTRY TO BE FAMILIAR WITH THE CONTENTS OF THIS BOOKLET.

SUPERINTENDENTS, FOREMEN AND OTHERS HAVING CHARGE OF MEN ARE ADVISED TO GIVE PRACTICAL INSTRUCTIONS AND DEMONSTRATIONS ON THE USE OF THESE RULES TO ALL OLD AND NEW EMPLOYEES.

PHYSICIANS WHO MAY BE CALLED UPON IN CASES OF ASPHYXIATION SHOULD BE GIVEN COPIES OF THESE INSTRUCTIONS, AND WHERE PRACTICABLE PLACED IN COMMUNICATION WITH THE PHYSICIAN OF THE GAS COMPANY.

THE PRONE PRESSURE METHOD OF ARTIFICIAL RESPIRATION DESCRIBED IN THESE RULES IS EQUALLY APPLICABLE TO RESUSCITATION OF THE APPARENTLY DROWNED, AND ALSO TO CASES OF SUSPENDED RESPIRATION DUE TO ELECTRIC SHOCK OR TO OTHER CAUSES.

Delay of even one minute may lose a life.

Knowledge of the proper methods of first aid and resuscitation is necessary for success.

The steps are simple. They are easy to learn.

BUT THEY MUST BE LEARNED BEFORE THE ACCIDENT.

Learn every word of this booklet and learn it now!

Don't wait for an accident; it may be too late then.

RULES FOR FIRST AID AND RESUSCITATION IN GAS ASPHYXIATION BY THE PRONE PRESSURE AND OXYGEN + CARBON DIOXIDE METHODS

Recommended by
COMMISSION ON RESUSCITATION FROM GAS ASPHYXIATION
Representing the
AMERICAN GAS ASSOCIATION

Issued by the
AMERICAN GAS ASSOCIATION
342 Madison Avenue, New York

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Associate Professor of Applied Physiology, Medical School of Harvard University.

What Carbon Monoxide Does

Carbon monoxide is the gas which makes illuminating gas, automobile exhaust gas and the smoke from fires poisonous to breathe. When carbon monoxide is breathed it combines with the blood. The more carbon monoxide there is in the blood, the less oxygen the blood will hold.

The gas victim becomes asphyxiated just as if he were being gradually choked to death. As low as one-tenth of 1 per cent. of carbon monoxide or even less, in the air will kill a man in time; 1 per cent. will kill in a few minutes.

If the patient does not die in the gas but is removed to fresh air, the carbon monoxide leaves the blood in a few hours. The quicker it is breathed out of the blood the better are the chances of recovery. If the asphyxiation has not been too long or severe, and the first aid treatment has been prompt and correct, the patient will recover completely.

Protect Yourself

Don't breathe gas yourself even for a short time. If it doesn't put you out, it will cut down your strength. If you have to go into gas to get a man out remember that nobody is immune. Protect yourself.

A handkerchief tied about the nose and mouth is not a gas mask; many have died in the belief that it is. It does not stop carbon monoxide; it simply filters off the irritating fumes in smoke, but carbon monoxide itself does not irritate the throat and has no smell. It gives no warning. It often paralyzes the legs first, and so suddenly that the man, even though conscious may fall down, and can not walk or crawl.

If you must go into gas or smoke, wear a mask and air hose, or an oxygen breathing apparatus, or a gas mask with canister. Be sure the mask is especially made to stop carbon monoxide. A smoke mask or an ammonia mask that does not stop carbon monoxide is particularly dangerous.

Get The Man Out Of Gas

When a man is overcome by gas, the first thing to do is to get him into fresh air quickly. Fresh air does not mean out of doors in cold weather. Many men have walked from a warm room containing gas to collapse in the cold outside air. Take the patient to a room free from gas and comfortably warm. Be quick, but don't be unnecessarily rough. Remember you are dealing with a human being.

If the patient is unconscious, place him on his belly in the position shown in Figure 5. If the patient is not breathing or his breathing stops, start artificial respiration at once by the prone pressure method. *Don't wait for apparatus or anything or any one else. Get to work with your own hands.* A delay of even a minute may be fatal. If the patient is breathing, wrap him warmly, lay him on his belly as in Figure 5, and give him an inhalation (to be described later).

Watch An Unconscious Man Every Minute

His breathing may stop. If it does, start artificial respiration again immediately.

A man who has been even slightly gassed should not be allowed to make any exertion. Keep him lying down. If he must be moved, carry him. The worst thing that can be done is to get him up and walk him around—as has been done sometimes. It may injure his heart or even kill him. Keep him on his belly as long as he is unconscious. This may prevent his choking; in this position artificial respiration can be begun instantly if necessary; the belly position may also prevent a later pneumonia.

When to Give Artificial Respiration and When to Give Inhalation

When a gassed patient is breathing, he should not be given artificial respiration. But he should be placed and kept in position (Figure 5) ready for artificial respiration in case he stops breathing. Start inhalation of oxygen + carbon dioxide immediately.

If the patient is not breathing, start artificial respiration immediately by the prone pressure (Schäfer) method. This is the best method for artificial respiration. It is better than any method using a mechanical device. If the victim is breathing, an artificial respiration apparatus may injure him. If he is not breathing, he may die while you are going to get the apparatus or getting ready to use it. It is the opinion of the Commission that such apparatus has led to the deaths of more people than it has saved.

In gas poisoning it is beneficial to give an inhalation of oxygen + carbon dioxide during artificial respiration. If anything can start a man breathing this will. When the victim starts breathing, stop artificial respiration. It then does no good and may do him harm. But continue the inhalation of oxygen + carbon dioxide.

How to Give Artificial Respiration by The Prone Pressure Method

(Follow these instructions even if patient appears dead.)

As soon as the patient is clear of the gas quickly feel with your finger in his mouth and throat and remove any foreign body (tobacco, false teeth, etc.). If the mouth is tight shut, pay no more attention to it until later. Do not stop to loosen patient's clothing, but immediately begin actual resuscitation. Every mo-

ment of delay is serious. Proceed as follows:

(1) Lay the patient on his belly, one arm extended directly overhead, the other bent at elbow and with face to one side, resting on the hand or forearm, so that the nose and mouth are free for breathing. (See Figure 5.)

(2) Kneel straddling the patient's hips with knees just below the patient's hip bones or opening of pants pockets. Place the palms of your hands on the small of the back with the fingers over the ribs, the little finger just touching the lowest rib, the thumb alongside of the fingers; the tips of the fingers just out of sight, as in Figure 5.

(3) While counting one, two, and with arms held straight, swing forward slowly so that the weight of your body is gradually, but not violently, brought to bear upon patient. (See Figure 6.) This act should take from two to three seconds.

(4) While counting three, swing backward so as to remove the pressure, thus returning to the position shown in Figure 7.

(5) While counting four, five—*rest*.

(6) Repeat these operations deliberately swinging forward and backward twelve to fifteen times a minute—a complete respiration in four or five seconds. Keep time with your own breathing.

(7) As soon as this artificial respiration has been started, and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest, or waist. Keep the patient warm.

(8) Continue artificial respiration without interruption until natural breathing is restored, if necessary four hours or longer, or until a physician declares rigor mortis (stiffening of the body) has set in. If natural breathing stops after being restored, use resuscitation again.

Take Care of The Patient

(1) Keep the patient warm. Every precaution must be taken to prevent a gas patient from becoming chilled. To be chilled means a strain on his already weakened vitality. It may kill him or help to cause pneumonia.. Wrap him in blankets and use hot water bottles or hot bricks. You can fill a hot water bottle from the radiator of an automobile. Be careful to protect the patient from burns by hot water bottles or bricks against the bare skin. An unconscious man has no way of telling you when he is being burned. A burn may be worse than the after effects of the gas.

(2) Breathing. Remember always; The most important thing is to see that the patient continues to breathe. If he stops breathing, don't wait for blankets or hot water bottles. Start artificial respiration.

(3) Treatment. Never give an unconscious man anything to drink. It may choke him. Never give whiskey. Whiskey acts on a man in much the same way as gas. It makes a gassed man worse. Hot black coffee is excellent if the man is conscious enough to drink it. When the patient has become conscious keep him wrapped up warmly. He must be kept quiet. He may want to get up or struggle. Keep him down. After he is conscious, turn him on his back if that is more comfortable but keep him lying down for at least six hours. Even a little exertion is bad and a gassed man may collapse if he tries to walk.

(4) After Effects. After the patient is conscious, it is the work of the doctor to see that he does not develop pneumonia

or other after effects of gas poisoning. If you have done your best and followed these instructions carefully, you have done much to prevent these after effects.

The Use of Inhalation to Drive Carbon Monoxide Out of The Blood

In gas poisoning oxygen used properly helps to drive the carbon monoxide from the blood. To do any considerable good the oxygen must be given during the first two hours after the man is out of the gas, the sooner the bettter. Sometimes the patients do not breathe well after they are brought out of gas. In fact some stop breathing entirely. Even those who breathe normally often can not get the gas out of their blood fast enough to prevent their being very sick or even dying afterwards. Pure oxygen does not stimulate the breathing. For this reason it is recommended that about 5 per cent. of carbon dioxide—which is the gas that is in soda water—be mixed with the oxygen. This makes the patient breathe much more deeply and thus allows the oxygen to drive the carbon monoxide out of the blood very rapidly. The carbon dioxide also keeps the breathing from stopping. It starts breathing more quickly in those on whom it may be necessary to do artificial respiration. It is useless to try to give an inhalation with a tank and funnel or any such makeshift. A properly designed inhaler and close fitting mask must be used.

The Commission on Resuscitation has examined apparatus on the market for administering the oxygen + carbon dioxide treatment and finds that at the present time *two devices alone* are adequate for this purpose. These devices are:

1. The H-H Inhalator, manufactured by the Mine Safety Appliances Company, 908-912 Chamber of Commerce Building, Pittsburgh, Pa.

2. The Industro Oxygenator, Universal Model, manufactured by the Protecto Safety Appliance Company, 90 Columbia Street, Newark, N. J.

Detailed directions for the use of these devices will be furnished purchasers with the appliance chosen. The direction sheets so supplied have been examined and approved by the Resuscitation Commission.

General Directions For Giving the Inhalation Treatment

Start using the inhaler as soon as you can after the patient is out of gas. If the patient has stopped breathing, start artificial respiration *immediately* and have an assistant apply the inhalation apparatus.

In using the apparatus, open the valve at the top of the steel bottle while the pointer on the dial is at O.

Put the mask over the patient's face. The lower part should go well down on the chin. Press down firmly over the nose. Try to prevent leaks.

As soon as the mask is properly applied, admit the oxygen + carbon dioxide into the bag and to the mask at a rate not exceeding ten liters per minute. If the man breathes less than the amount fed, the bag will stay full. If he breathes more than the amount, the bag will collapse. As inhalation proceeds, adjust the valve so that the bag does not quite collapse at each breath, but do not give any

more than just all the patient takes from rapidly exhausted if wasted. Continue the bag, for the gas in the tank will be rapidly exhausted if wasted. Continue the inhalation for twenty to thirty minutes or even forty minutes, depending upon the severity of the case and until the patient is conscious and can answer questions. In using the inhalation treatment the patient must be kept in the position shown in Figure 5.

If metal bottles of oxygen + carbon dioxide are not available or become exhausted, pure oxygen should be used. Oxygen alone is, however, a substitute and does not fulfil the requirements for which the inhalation treatment has been designed.

REPORT NO. 2.

Final Report of the Commission on Resuscitation From Carbon Monoxide Asphyxia

The Treatment of Carbon Monoxide Asphyxia

In November, 1921, a commission,* formed at the request of the American Gas Association, began an investigation to determine the best means of treating individuals poisoned by illuminating gas. The task of this commission was finished on March 1, 1923. The researches undertaken and the conclusions reached are summarized in this report.

The work accomplished may be divided into two definite parts. The first of these deals with the general status of the problem of resuscitation from gas poisoning in this country, together with an analysis of certain features of resuscitation as now practised, which were felt to be poorly understood and possibly harmful. The second and more important part of the work consists in an effort, which the commission has every reason to feel has been successful, to provide a new and more efficient means for resuscitation. These two divisions of the problem before the commission are best presented in the above order.

1. *The Present Status of Manufactured Gas Poisoning as Related to Resuscitation, with a Critical Review of Certain Phases of Modern Resuscitation Practice*

Inquiry was first made as to the condition of patients when first found after exposure to illuminating gas. It became apparent that although seriously affected individuals are practically always unconscious, they are usually still breathing. This breathing may be feeble and ineffectual but in patients who recover, respiration is practically never absent when the victims are first seen. The situation differs from electric shock. In electric shock the respiration ceases suddenly and the heart continues for a brief time.

Victims are revived if some one starts artificial respiration at once. In gas poisoning, on the other hand, there is frequently a long period of unconcsiousness, during which the respiration is, at first, more vigorous than normal. Then follows a period in which breathing is shallow and ineffectual; finally, respiration fails. While the circulation may be fair when respiration stops, the circumstances attending gas poisoning are such that aid rarely appears just as the respiration ceases. When first discovered, victims are either dead or else, though unconscious, they are breathing slightly or even fairly well. If, now, we inquire into what is done for such individuals we are unable to find that such devices as the pulmotor and the lungmotor are more efficient, in the instances in which artificial respiration is necessary, than is the manual prone pressure method of resus-

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citation. At the same time, it is evident from our investigations that if rescue crews do possess apparatus for artificial respiration, they use their machinery at times even though the victim's breathing may be excellent.

We are, thus, faced with the fact that if a person in one of our large cities is overcome by gas, he is very likely, whether he needs it or not, to experience a period of artificial respiration by means of some such device as the pulmotor or the lungmotor — a device which alternates positive blasts of air with suction, thus producing inspiration and expiration in a manner exactly contrary to the meaning of these words and to the normal physiology of breathing.

The commission next investigated what happens to seriously gassed patients taken to representative hospitals in Boston, New York, and Philadelphia. The significant facts obtained, which are related to the resuscitation problem, are as follows: In a series of 860 patients, admitted to hospitals because of gas poisoning, 59.8 per cent were unconscious; 27.8 per cent showed abnormal amounts of moisture in the respiratory tract; 5.9 per cent eventually developed pneumonia (these pneumonias were cases actually diagnosed; study of the records indicates that the true percentage is probably higher, numerous cases with slight patches of bronchopneumonia being undiagnosed); and 14.5 per cent died. Serious cases, as has often been reported before, show low blood pressures, and cardiac arrhythmias and dilation are not infrequent. This delineation of the situation has been published as the second report of the commission (1).

In view of the facts thus disclosed, the commission, in October, 1922, felt it advisable to make inquiries in three lines.

1. Since at the present time the use of resuscitation apparatus, such as the lungmotor and the pulmotor, is widespread, and since it is evident that if such apparatus is at hand it is employed, even if the breathing of the patient requires no assistance, the question arose as to whether exuberant use of positive pressure ventilation might not cause immediate cardiac or circulatory failure in seriously gassed patients. It is known that artificial respiration of positive type increases, at each blow, the pulmonic blood pressure by compressing the pulmonary capillaries. The load which can be thrown suddenly upon the right ventricle in this way may be considerable, and, accepting the fact that such machines as the lungmotor and pulmotor occasionally do drive the full air delivery of the instrument into the alveoli, the possibility of doing harm is easily recognized. It has, however, been shown by workers for the commission in a series of experiments upon cats, poisoned with illuminating gas, that this apprehension in regard to positive pressure respiration apparatus is unfounded. In the same investigations, lung rupture did not occur even though extreme pressures were used.

2. Since pneumonia is a fairly frequent and very serious sequel of gas poisoning and since one-fourth of gassed patients receiving hospital treatment have excess fluid in their respiratory tracts, the question was asked as to whether positive ventilation, if effective, might not aid in the distribution of infected mucus to the alveoli and so increase the incidence of pneumonia. A series of experiments upon dogs and cats has shown that artificial respiration carried on through a mask by an instrument, such as the lungmotor, does cause an increase in the amount of tracheal material which reaches the lungs. The possibility, therefore, exists that pos-

itive pressure artificial respiration, operating through a face mask, may increase the incidence of pneumonia after gassing.

3. Since little data exists as to the actual ventilating efficiency of the lungmotor and the pulmotor, experiments have been performed upon dogs which have shown that while non-breathing animals (curarized) can be kept in good condition by such devices, the amounts of air delivered have to be modified in accordance with the condition of the animal at the moment. An experienced physiologist can do this successfully but, out of medical hands and with the simple directions which can be given non-medical life savers, it is not probable that the machines can be operated with the success that is attributed to them. The investigators were surprised to find how readily small amounts of obstruction in the upper air passages stopped the air flow when positive ventilation was being used. It is this fact which necessitates constant watchfulness upon the part of the operator and readiness to adapt the volume of air delivered to the needs of the patient. A further practical difficulty in using positive pressure respiration through a face mask was found in experiments upon individuals, apneic after forced breathing, and upon the bodies of persons dead less than two hours. This consists in the ease with which leaks occur around the edges of the mask. These leaks are invariably greater when air is blown in than when it is sucked out, since during the latter manoeuvre the skin of the face is drawn against the rim of the mask and seals off some of the leakage. As a consequence, the victim, upon whom the face mask is not adjusted with the greatest accuracy, experiences a gradual diminution in the size of the chest, and an interference with alveolar air exchange which cannot be advantageous.

Finally the question of the actual efficiency of the Schafer prone pressure method of artificial respiration was reviewed and the conclusion reached that this method is even more efficient than has been supposed. That is, evidence exists which indicates that the Schafer method is not simply our best reliance for brief emergencies but that, through its use, life may be sustained over considerable periods of time in persons unable to breathe.

The experimental evidence and discussion of these matters make up the third report of the commission(2).

II. *The New Method of Treating Carbon Monoxide Asphyxia*

The development of this new procedure is entirely due to the work of Dr. Yandell Henderson and Dr. H. W. Haggard and forms the most important contribution made by the commission. The extreme simplicity of the measure proposed and the apparent completeness with which it meets the needs of gassed individuals cannot be overemphasized. Three well-known facts form the basis for the method. They are:

1. Carbon monoxide combines with hemoglobin, displacing oxygen, and the harm done in gas poisoning arises from the oxygen deprivation which results.

2. The most effective physiological means for breaking down the combination of carbon monoxide and hemoglobin is offered by the mass action of oxygen; that is, in the presence of large amounts of oxygen, carbon monoxide is forced out of the hemoglobin molecule more rapidly than in lower oxygen concentrations.

3. The most effective physiological stimulus for respiration is carbon dioxide.

Because of these three facts and because of the observation that in gassed persons the carbon dioxide content of the body is low, owing to the period of excessive breathing which precedes the stage of shallow respiration and respiratory failure, Henderson and Haggard have advocated the use in gassed cases of inhalations of 5 per cent carbon dioxide in oxygen. They have shown in gassed animals and in themselves that this mixture, because of the carbon dioxide content, causes a great increase in respiration. This respiratory increase fills the alveoli with a very high percentage of oxygen and thus displaces carbon monoxide from the hemoglobin molecule with the greatest possible expedition. They have also shown that the breathing of this carbon dioxide-oxygen mixture is attended by no danger to the subject. Following these observations, Henderson and Haggard tested the carbon dioxide-oxygen treatment upon gassed persons in New York City. Further experience with the method, both in reviving gassed persons and in hastening recovery from etherization, has served to increase the confidence of the commission in the wisdom and safety of a treatment which not only meets an immediate emergency but also, by shortening the period of oxygen lack, reduces the frequency after gas poisoning of unfortunate sequelae. The development of this new treatment forms the subject matter of the first report (3) of the commission.

Conclusions

1. The commission has found no evidence to indicate that artificial respiration apparatus operating by positive pressure, such as the lungmotor or the pulmotor, produces results in resuscitation from gas poisoning superior to those obtained by the use of the Schafer prone pressure method of resuscitation alone. The commission is of the opinion that the employment of such devices may often do actual harm and strongly recommends that the prone pressure method be employed.

2. Since the great requisite in all resuscitation work is prompt action, the commission urges that large corporations, faced by a carbon monoxide hazard, train numerous individuals to give artificial respiration by the Schafer method. When this work is entrusted to a few small teams delay is caused in waiting for a member of a team to arrive. Gas companies must supply first aid to the public through their rescue crews. They should, however, use every possible effort to spread sound knowledge upon the question of resuscitation from gas poisoning, so that more and more people know how to meet the immediate emergency which gassing may present.

3. The commission recommends the use of the carbon dioxide-oxygen inhalations developed by Henderson and Haggard as a treatment for gas poisoning. To provide this treatment, apparatus is necessary and the general objection of delay, which is inherent in all methods of resuscitation demanding apparatus, applies in this case. Since, however, the inhalation provides a specific remedy for use in gassed persons, the handicap of delay must be accepted and overcome as far as possible by proper placing of apparatus. It is obviously of extreme importance that the inhalations be given promptly. Unconsciousness may persist long after carbon monoxide has left the blood. This prolonged unconsciousness is an expression of the harm done by a prolonged period of oxygen lack—the very situation which the inhalation is preeminently adapted to prevent.

4. The commission has concluded its work by preparing a booklet giving speci-

fic directions for performing the Schäfer prone pressure method of artificial respiration and the new carbon dioxide-oxygen inhalation treatment. This booklet may be obtained from Mr. Oscar H. Fogg, Secretary-Manager of the American Gas Association, New York City.

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Carbon Monoxide Asphyxia: B. Artificial Respiration*

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In a previous report (1) an effort was made to define the problems which must be met in providing resuscitation in cases of gas poisoning. An examination of statistics gathered from the experience of representative gas companies and from hospitals showed:

1. That patients poisoned by illuminating gas who eventually recover are practically invariably breathing slightly when first found. Exceptions to this may occur but they are rare.

2. That rescue crews trained in the use of resuscitation apparatus apply the instrument carried by them if they believe the condition of the patient to be poor, regardless of the respiration at the time. Thus, frothing at the mouth, stertorous or irregular breathing, and profound coma are apparently taken as indications that something must be done and the apparatus at hand is utilized, regardless of actual indications at the moment.

3. That 28 per cent of serious cases of gas poisoning taken to hospitals have excess fluid in the respiratory passages.

4. That, in a series of 860 cases of gas poisoning, pneumonia was diagnosed as an eventual complication in 5.9 per cent of these cases and that it probably occurred, but was undiagnosed, in a number of other instances.

Artificial respiration is of two types, negative and positive. Negative pressure artificial respiration is provided by the various manual methods which have been devised. Of these the Schäfer (2) prone pressure method is the best. In this type, as in the others, the operator compresses the thorax and, on release of this pressure, air is sucked into the alveoli as the chest expands to normal position. The

*Report III of the Commission on Resuscitation from Carbon Monoxide Asphyxia.

procedure resembles normal respiration in that the mechanical call for air is accomplished in the part of the lungs where the air can be of use.

Positive pressure artificial respiration is applied by various devices which drive air into the lungs. Of commercial apparatus for this purpose, the pulmotor and the lungmotor are the most widely known and used and were the instruments employed in the cases covered by the previous report of the Commission and referred to in the findings which have been listed.

Certain questions which arose from study of the material in Report II (1) form the basis of the present report and are treated in the sections of which it is composed.

1. *The Effects of Positive Ventilation on the Pressure in the Pulmonary Arterial System*

If air is pumped rhythmically into the trachea of an animal it is readily possible not only to make the systematic blood pressure rise and fall with each respiration but also to force the blood pressure to high and low mean levels. Henderson (3) and Dale and Evans (4) have shown that excessive artificial respiration causes the blood pressure to fall to dangerously low levels in an exceedingly short time. These extreme effects are attributable to withdrawal of carbon dioxide and do not enter the problem of resuscitation. Lesser effects, however, occur for purely mechanical reasons and it seems possible to us that, in the presence of low blood pressure, a further and dangerous lowering may result from injudicious positive ventilation. Figure 1 illustrates an experiment (AA 1) upon a cat anesthetized with urethane and curarized. In Tracing 1 the animal is receiving 625 cc. of air per minute, at a rate of 47 strokes of an artificial respiration pump,* and with a maximum positive pressure of 30 mm. of water. In Tracing 2 a shift has been made so that the animal is receiving 774 cc. of air per minute, at a rate of 24 strokes of the pump and with a maximum pressure of 60 mm. Tracing 3 exhibits the return to the original conditions operative in Tracing 1. In this experiment, the total volume of air moved varied only moderately. In order, however, to keep it approximately level during the period of slower pump rate (Tracing 2), it was necessary to increase the air delivery per stroke—an adjustment which resulted in a doubling of maximal inflow pressure.

This demonstration indicates clearly the subtlety of the problem of providing positive pressure ventilation without placing the animal at some disadvantage. Within any such limits of air flow as would be selected for physiological experimentation, the blood pressure usually remains satisfactory, and in Figure 1 it is not reduced to a dangerously low level. It requires very little observation, however, to ascertain that for each animal there is an optimum stroke and rate of air delivery, judged by maintenance of blood pressure. This optimum condition is not necessarily attained by imitating, in terms of positive pressure ventilation, the rate and volume of normal negative pressure ventilation operative in the animal just prior to such a manoeuvre as curarization. Factors such as the rigidity of the chest, abdominal distention and muscular tone, all play a part in determining the proper adjustment of artificial respiration apparatus so as to ensure delivery

*The respiration pump employed in this experiment and to some extent in later experiments will be described in a forthcoming publication. It permits rapid changes in rate by gear shifts and in volume delivery by adjustments in length of stroke, and will maintain constant air deliveries within ordinary limits of pressure for long periods of time. Expiration is passive.

to the alveoli of a suitable amount of air under minimal delivery pressure. The ideal amount of air and pressure will, of course, differ in value for each animal and for each person. The explanation of these rapid changes in mean blood pressure, as a result of changes in ventilation pressure, depends, in the main, upon interference with cardiac filling because of an increased intrathoracic pressure.

In a recent study upon *The Effect on the Circulation and the Lungs of Different Mechanical Methods of Resuscitation,* in which positive pressure and suction apparatus (the pulmotor and a somewhat similar machine, the Brat apparatus) were tested upon human beings, Bruns and Schmidt (5) came to the following conclusions:

"In respiration through positive pressure and suction methods, as provided by the pulmotor and the Brat apparatus, the physiological relationships are changed so that during the mechanical inflation of the lungs the total pulmonary vascular bed is narrowed and the venous blood is stagnated in the periphery, as we see it in severe cases of heart disease.

"The suction of air from the lungs which follows does not improve this circulatory disturbance. The peripheral venous system becomes even more congested."

The authors arrived at these conclusions by plethysmographic and venous pressure measurements during use of the two instruments mentioned. Our experiments upon animals make the situation ever more graphic.

As positive pressure artificial respiration becomes excessive, a second circulatory factor appears. With each excessive inflation of the lungs, the pulmonary capillaries are compressed and the pulmonary arterial pressure is greatly increased. This means that a heavy load is thrown rhythmically upon the right ventricle. In the healthy organism under good conditions this may do little damage, but the heart of the gassed individual is not necessarily normal.

Zondek (6), through X-ray studies, has shown that illuminating gas poisoning produces cardiac dilation in rabbits. He did not find this condition in the more muscular hearts of cats but his method of examination disclosed only extreme degrees of change. Dilation and myocardial degeneration following gassing (7) have frequently been observed in man, and it is undoubtedly the case that, as the anoxemia of gas poisoning progresses, the right ventricle faces the possibility of increasing inability to cope with undue stress.

In view of such a possibility, the question occurred to us as to the effect upon a right ventricle, weakened by gassing, of a sudden period of injudicious artificial respiration with a positive pressure respiration device. In order to test this matter, we employed as positive pressure respiratory devices, the motor-driven pump previously described; the lungmotor* which typifies a simple style of resuscitation device operation through positive

*The lungmotor consists of two simple pumps, mounted upon a common base and provided with intake and output valves. Air, or any desired gas mixture, is delivered to an inlet tube in a face mask by one of these pumps and is withdrawn through a second tube by the companion pump. The apparatus is extremely simple and well constructed. The length of the stroke of the pump can be altered so as to deliver different amounts of air. The amounts of air delivered at the various strokes for which the pump can be set are supposed, if given at the rates designated, to meet the needs of individuals of different ages and sizes. We have found the pump to deliver less air per stroke than the amount advertised. While this failure to reach the advertised output should be recognized, it is not of great importance since the volumes of air supplied at the different strokes and rates indicated are still in excess of the amounts required by resting individuals of the ages and sizes specified, **provided all the air reaches the lungs.**

pressure and entirely under the control of the operator; and a pulmotor° of the original type, reversing automatically. We have purposely established radical conditions of experimentation since the point to be tested was whether or not intemperate use of positive pressure respiration could suddenly overtax a heart already damaged by a period of gas poisoning.

Owing to the fact that the two pumps communicate through the face mask, excess pressure development is prevented, though not so completely as we were led to believe. The prevention of excess pressure is accomplished by the fact that when a positive pressure in the neighborhood of 90 to 100 mm. of Hg is developed, the expiratory valve opens and, similarly, with a negative pressure of 70 mm. of Hg, the inspiratory valve opens and prevents further negative pressure effects upon the lungs.

Gassing Experiments

In experiments concerned with the effects of gassing upon the circulation, cats have been used as test animals, since previous work on cats in this laboratory has acquainted the authors with technical methods of preparation which enable an investigator to measure, with great readiness and at the same time, the various factors thought to be of importance in the situation under examination. The analysis of a single experiment will illustrate the work accomplished.

Protocol 1.—Exp. 9. A cat weighing 3 kg. was anesthetized with urethane (2.5 gm. per kg.). The heart was exposed in the manner illustrated in a former publication (8). A cardiometer, slipped over the ventricles, was connected with a delicate volume recorder by means of which record *a,* Figure 2, was written. Respiration, recorded by means of a sensitive pneumograph and tambour, is shown in record *b* in the same figure. Record *c* is the femoral blood pressure recorded with a mercury manometer, and record *d* is the pressure in the pulmonary artery. For this last measurement, a special cannula (9) and a membrance manometer were employed. A time marker writing 3-second intervals (record *e*) completes the figure.

Artificial respiration through a tracheal cannula is necessary during exposure of the heart, but after closure of the thorax with the pericardium, the animal is allowed to resume natural breathing. Tracing 1 (Fig. 2) indicates the conditions under which inhalation was begun of air mixed with Boston illuminating gas, so diluted as to give 60 to 65 parts of CO in 10,000 parts of air. Tracing 2 shows the state of affairs after 2 minutes gas inhalation, Tracing 3, after 5 minutes gassing; Tracing 4, after 7 minutes gassing and during the period of cessation of respiration.. At mark 1 (Tracing 4) on the base line for pulmonary arterial pressure, the gas inhalation tube was disconnected, and at mark 2 artificial respiration with the lungmotor was begun. The instrument, set at the smallest possible stroke, delivered 74 cc. of air per stroke, and was operated at a rate of 20 strokes per minute. The maxi-

°The pulmotors at present in use consist of two general types, the first (Type A) being the original form which supplies oxygen mixed with air. This machine, through an ingenious mechanism, shifts from air delivery to air withdrawal when a certain delivery pressure is reached. To operate effectively this reversal must not occur until the lungs are inflated, but such an ideal result is not attained unless there is absolutely no obstruction to inflow. In the event of obstruction, reversal pressures are reached very rapidly and the alveoli remain uninflated. The second type of pulmotor (Type B) substitutes positive pressure for suction, at the will of the operator. It offers a complicated method for doing what is accomplished very simply by the lungmotor and any objections to the latter instrument apply with greater emphasis to this variety of pulmotor. Both types of pulmotor may be operated by compressed oxygen or air. In Type B compressed air is ordinarily supplied by a pump which is worked by hand. The lungmotor is operated by hand like an ordinary automobile tire pump.

mum air pressure developed on inspiration was 20 mm. of Hg, while a negative pressure of 4 mm. of Hg was attained on air withdrawal. The ventilation thus provided is somewhat excessive for the cat. Under its influence, the cardiac dilation which existed when artificial respiration was begun, diminished markedly. The pulmonic blood pressure, which had been maintained at a very constant mean level of 12 mm. of Hg, showed little or no mean pressure change. After conditions had become stabilized, the maximum pulmonic blood pressure attained at the height of the inspiratory stroke of the pump was 20 mm. of Hg.

At this point the lungmotor was shifted through two further increases of stroke. The first increase gave 179 cc. of air per stroke, with a maximum positive pressure of 28 mm. and a negative pressure of 10 mm. of Hg, the rate of the pump being 20 per minute. Under this extreme ventilation, systemic blood pressure fell and pulmonic blood pressure rose to 27 mm. of Hg. Tracing 5 indicates the final increase in ventilation, 283 cc. of air per stroke, at 20 strokes per minute and then finally at 15 strokes. At the rate of 20, the maximum pressure of air delivery was 46 mm. of Hg and the negative pressure on withdrawal, 32 mm. of Hg. The large ventilation employed steadily lowered the systemic blood pressure and under the maximum positive pressure the pulmonic blood pressure became 30 mm. of Hg.

A short period of ventilation under the conditions existing at the beginning of the artificial respiration next followed, at the end of which the lungmotor was removed. The animal at once breathed naturally, his heart size and his systemic pulmonic blood pressure returned to their original values. A second period of gassing was next given and the experiment repeated. Tracing 6, taken after respiration had failed from the second gassing and the lungmotor had again been applied, shows the effect of disconnecting the suction tube from the lungmotor and of occluding the air exit of the tracheal cannula. Under circumstances such as these, each positive stroke throws air into the lungs and there is no way for it to escape. Such a manoeuvre, if carried to extremity, shuts off the flow of blood from the right to the left ventricle, and resulted, in this experiment in a prompt fall in systemic blood pressure and a rise in pulmonic pressure to a height of 68 mm. of Hg. This radical procedure was operative during 5 strokes of the pump but, as is evident in the tracing, was not fatal.

As a whole, the experiment illustrates the readiness with which pulmonic blood pressure follows increases in ventilation but even with the extreme measures used, heart failure did not occur. This was probably due to the fact that inflow of blood into the right ventricle is reduced as artificial respiration becomes excessive. As a consequence, very high pulmonic blood pressures are only momentary, the mean pulmonic pressure remaining nearly normal. We have found it impossible to obtain long continued gassing in anesthetized animals. In acute gassing, we have repeatedly seen heart block as recently described by Haggard (10)—indeed, in the experiment cited, heart block occurred shortly before the second failure of respiration but in all cases our results were negligible as far as immediate critical damage from excessive air pressure was concerned.

In order to test the immediate effects of excessive positive pressure ventilation under conditions more nearly approaching those attending gassed persons, we subjected animals to prolonged gassing by air diluted with illuminating gas so as

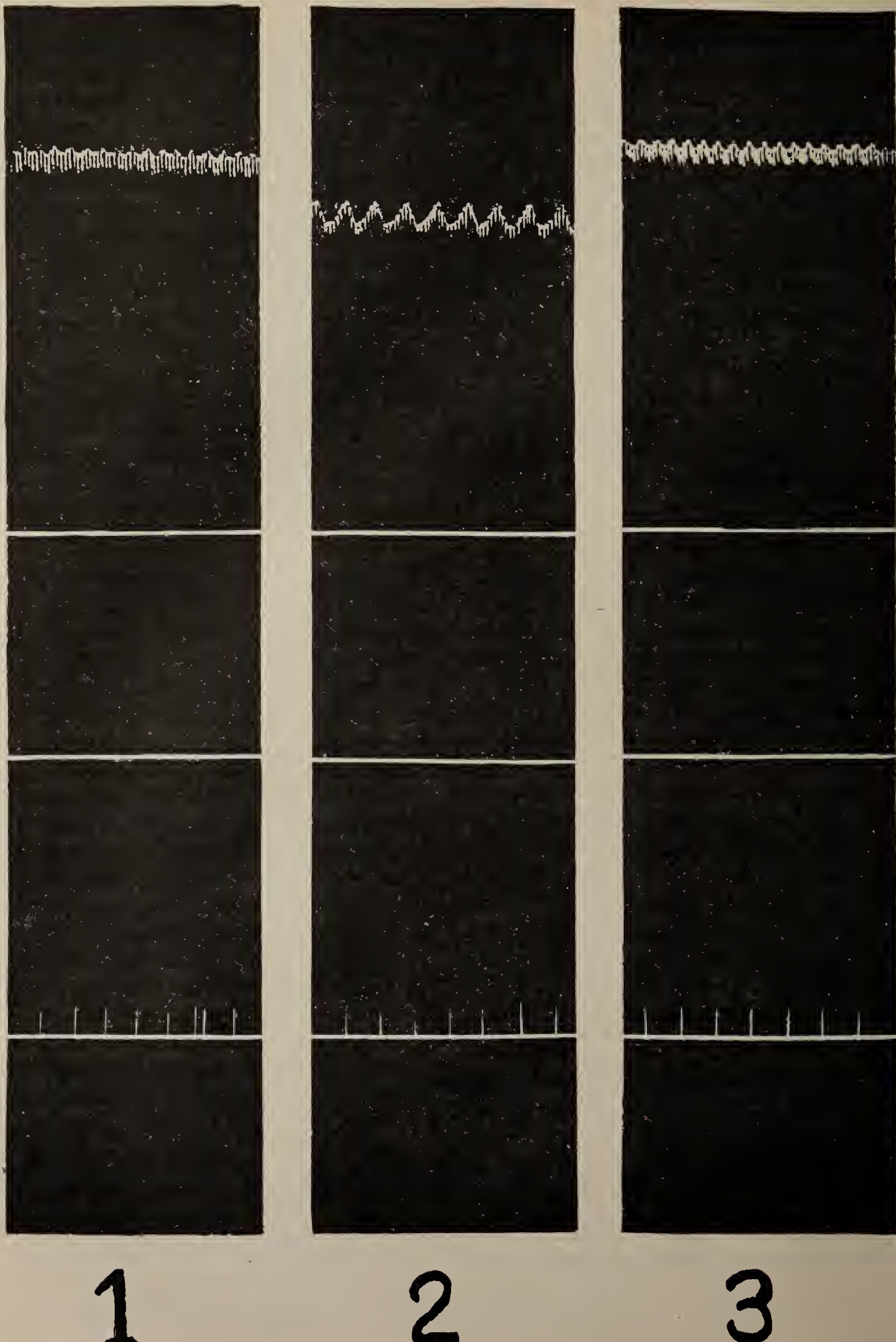

FIG. 1
Tracings illustrating the effect on blood pressure of increasing the maximum pressure under which air is delivered, the total ventilation per minute being kept approximately the same.

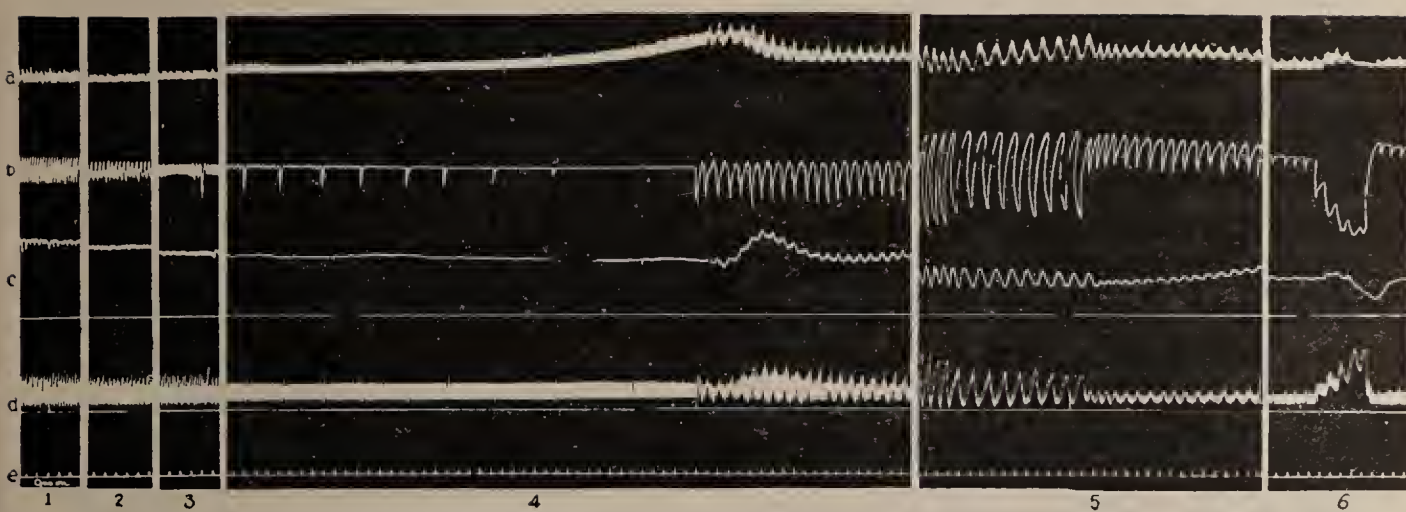

FIG. 2

The heart volume (a), respiration (b) systemic blood pressure (c), and pulmonary arterial pressure (d) in a cat during poisoning with illuminating gas and resuscitation with the lungmotor. The lowest line (e) indicates 3-second intervals.

to give 20 parts of CO in 10,000 of air. This procedure was followed by cannulation of the trachea and of the femoral artery when the gassed animal had become profoundly unconscious. For example, at 10.18 a.m., a cat was placed in an atmosphere of air containing 20 parts of CO in 10,000. At 3.10 p.m., the concentration of CO in the atmosphere was raised to 30 parts in 10,000 of air. At 3.32 p.m., the animal was removed, the trachea and the femoral artery quickly cannulated, and the cat again allowed to breathe the air-gas mixture used at the beginning of the experiment. At 4.14, breathing having ceased, the lungmotor was employed under extreme conditions of ventilation pressure, without causing immediate death by heart failure.

The pulmotor proved equally innocuous in causing damage from excessive air pressure. It seems justifiable, therefore, to conclude that while positive pressure ventilation, even with moderate amounts of air, may cause large percentile increases in maximum pulmonary blood pressure—increases which become extreme if the ventilation is forced—nevertheless, no sudden damage is done to the gassed heart which was normal before gassing began. Since carbon monoxide can undoubtedly produce myocardial changes, it is possible that the use of positive ventilation apparatus in the hands of excited and poorly trained persons might add a strain which would be immediately destructive in the case of hearts previously diseased. This is not, however, a problem susceptible of satisfactory experimental analysis.

Positive pressure ventilation has been accused of causing lung rupture. We have tested for this repeatedly, opening the chest of animals with care and immersing the lungs in water with artificial respiration in progress, and have not found alveolar rupture. Here again, experiments can only apply to normal lungs. We know that spontaneous pneumothorax is a not infrequent occurrence in individuals who have given no outward signs of disease, but the general opinion seems to be that such an occurrence always denotes pre-existent lung damage. The possibility that positive ventilation might rupture a diseased lung can never be safely dispelled by animal experimentation. Human lungs are rarely as sound as those of healthy dogs and cats.

11. *The Effect of Positive Ventilation in Distributing Infected Material Throughout the Lungs*

Victims of gas poisoning frequently exhibit symptoms of pulmonary edema and, as has been shown (1), more than a quarter of those treated in representative hospitals give signs of having increased amounts of fluid in the respiratory passages. Since the possession of apparatus for artificial respiration apparently engenders an irresistible impulse in rescuers to use this apparatus, even when gassed individuals need no assistance in breathing, it is evident that persons unconscious from gas poisoning, in whose tracheas material is bubbling, must frequently be exposed to the possibility that the positive blast of air will throw bits of infected mucus broadcast through the alveoli. It has proved impossible to obtain statistics upon the incidence of pneumonia in gassed cases treated with the pulmotor or with the lungmotor, as contrasted with those treated in other ways, lacking such evidence, we have attempted to investigate the degree to which a positive blast of air will force finely divided substances into the depths of the lungs.

It is worth while, first of all, to realize the ease with which very large amounts

of material can slip into the lungs during states of unconsciousness. Holscher (11), in a careful investigation of the causation of post-operative pneumonias, showed that in etherized rabbits, cats, and dogs infected mucus placed in the tracheas caused bronchopneumonia in dependent parts of the lungs. That is, if the animal was upon its back, infection might be upon either side; if turned to the right, infection was upon the right side, and so on. These observations were preceded by a series of dye stuff injections which gave a similar distribution. More recently, Mullin and Ryder (12) have shown that suspensions of carbon and of tubercle bacilli dropped into the noses of rabbits enter the lungs with the greatest ease. Corper and Robin (13) have extended these observations still further and have shown how readily one may direct fluid, placed in the nose or mouth, into different parts of the lungs by simply altering the position of the animal. Such observations as these indicate that an individual in prolonged unconsciousness from gas poisoning is fairly certain, if lying upon his back, to experience the entrance of mouth material into the posterior and dependent parts of the lower lobes. Will this apparently inevitable ingress of infected material be assisted or made more widespread through the action of positive ventilation?

Experiments upon Distribution of Material during Positive Pressure Ventilation

A preliminary set of experiments with India ink in urenthanized cats verified the findings of previous observers. Material of this sort, introduced into the mouth or trachea without pressure, flows into the lungs as readily as if poured into a bottle. When animals were arranged so that the lungmotor operated during and after the injection, it seemed to us that the material was somewhat more disseminated than in animals which breathed naturally during the procedure. In order to obtain results of a more quantitative nature, the following procedures were undertaken. A suspension of very finely divided manganese dioxide was used instead of the ink. This permitted chemical quantitation, in terms of manganese, of the amount of material reaching the lungs. In order to make this suspension simulate mucus, it was diluted one-half with egg white. Under such circumstances, the final suspension would run slowly through a moderate sized syringe needle. The experimental animal was anesthetized with urethane and placed upon an animal board which was raised at the foot so that the board made an angle with the surface of the table — in some cases of 9°, in others, of 17°. The manganese suspension was contained in a burette and was introduced into the respiratory tract, through a syringe needle thrust through the tracheal wall just below the larynx. Under these circumstances, comparatively little of the material dripped into the trachea runs into the lungs. Animals were compared in pairs, the suspension being introduced, in the one case, during natural breathing and, in the second case, with the lungmotor in operation. An accurately fitting face mask was used to connect the lungmotor with the animal. Sample protocols are as follows:

Protocol 2.—Exp. C4. A cat, weighing 3.8 kg., was anesthetized with urethane and placed upon a cat board, the foot of which was so raised that the board made an angle of 9° with the surface of the table. 2 cc. of a manganese-egg-white suspension were slowly dripped into the trachea immediately below the larynx during a period of 27 minutes. Just be-

fore the injection was begun, the animal was curarized and the lungmotor applied by means of a tight-fitting face mask. The lungmotor was operated throughout the period of injection and for 10 minutes thereafter, at a rate of 20 strokes per minute, its nozzle delivery of air per minute at this rate being 1485 cc. On chemical analysis, the lungs contained 0.91 mg. of manganese per 100 gm. of wet tissue. This is an increase of 1200 per cent as compared with the control animal into which manganese-egg-white suspension was injected during normal respiration. The lungs of a second cat prepared and ventilated with the lungmotor in an exactly similar manner contained 130 per cent more manganese per gram of tissue than the control animal. If large dogs are used, the lungmotor permits sufficient adjustment to enable one to measure the natural ventilation of the anesthetized animal and then to imitate it with the lungmotor more exactly than is possible with cats. If normal ventilation is accurately imitated and artificial mucus is then placed in the trachea, it is very easy to kill the animal, since it frequently happens that though the nozzle delivery of the apparatus is the desired amount, the volume of air actually reaching the lungs is too small to sustain life. In order to avoid the predicament which arises in this way, the experiments involving artificial mucus in the trachea have often been done, perforce, under a somewhat excessive nozzle air delivery.

Protocol 3.—Exp. C7. A dog weighing 14.9 kg., was anesthetized with urethane and, after ligation of the esophagus, was placed on an animal board, the foot of which so raised that the board made an angle of 17° with the surface of the table. The animal was then curarized and the lungmotor set into operation. During a period of 30 minutes, while the lungmotor was operating, 6 cc. of manganese-egg-white suspension were dripped slowly into the trachea. The normal ventilation of the anesthetized dog, prior to injection of the artificial mucus, was 5100 cc. per minute. The ventilation (i. e., the nozzle air delivery) provided by the lungmotor was 5650 cc. per minute. During the period of artificial respiration (36 minutes) the condition of the dog became very bad from insufficient air and death occurred before the animal could be bled to death, this final bleeding being a routine procedure in order to give approximately equal weight conditions in the lungs. The amount of manganese recovered from the lungs in this animal was 0.017 mg. per 100 gm. of wet tissue. A control dog treated in exactly the same manner and breathing naturally showed 0.00039 mg. of manganese per 100 gm. of wet tissue, i. e., approximately one forty-third of the amount obtained in the animal ventilated artificially.

Both dogs and cats treated in this way invariably showed more manganese in the artificially ventilated lungs. The degree of increase varied markedly in the different experiments but was always in the same direction. Apparently, if one utilizes an air blast which is sufficiently vigorous to get air into the alveoli in anything like normal amounts, he is in danger of carrying in material from the upper respiratory tract.

III. *The Ventilating Efficiency of Artificial Respiration Apparatus*

In the second section of this report we have remarked upon the difficulty of getting adequate amounts of air into the lungs of animals unless the lungmotor is adjusted to give air deliveries above the actual requirements of the animal, as judged by the volume of air breathed

prior to the institution of artificial respiration. Any one who investigates this problem will be surprised at the ease with which the upper air passages become obstructed. The face mask used by us was absolutely tight—a criterion not met by the face masks provided with the apparatus—the esophagus was occluded, and the tongue held forward by a stitch. Even with all these precautions, ventilation was frequently inadequate. The exact position of the head, small amounts of material in the larynx, and other apparently insignificant factors tended to shut off air flow.

In the hands of operators thoroughly used to physiological experimentation, the rate and stroke of the lungmotor can always be adapted to provide adequate ventilation. The same thing is true of the hand controlled type of pulmotor. Such adjustments, in our opinion, involve the utilization of experience not possessed by the average doctor, much less by the lay members of an ordinary rescue squad. In view of this conviction, we were anxious to find out just how adequate is the ventilation provided by the lungmotor when the operator subjects it to the test of animal experiment under conditions simulating actuality.

A. Animal Experiments

The dogs employed in this series of experiments were anesthetized with urethane and were placed upon their backs on animal boards. In each case, the esophagus was occluded with a ligature, the tongue held forward by a stitch, and a glass face mask slipped over the muzzle. This mask was made air-tight by means of a rubber cuff reinforced with adhesive tape. Two glass outlets in the mask permitted quick adjustment of the lungmotor or the pulmotor. The carotid artery was exposed and provided blood for oxygen and carbon dioxide analyses. The following protocols illustrate the results of this type of experiment:

Protocol 4.—EXP. D2. DOG; WT., 13.6 KG.

Time	Procedure and Respiratory Findings	Blood Gases in Volumes Per Cent CO_2	Blood Gases in Volumes Per Cent O_2
a.m. 11.17	Normal ventilation	37.3	21.6
p.m. 12.05	Normal ventilation. Rate, 29; volume, 3341 cc. per minute.		
12.06	Ventilation with lungmotor begun. Rate, 20; volume, 3580 cc. per minute.		
12.07	Curarization.		
12.23		40.1	18.3
1.08		42.1	17.6
1.15	Lungmotor ventilation increased. Rate, 20; volume, 5650 cc. per minute.		
2.06		34.2	21.4
2.12	Lungmotor ventilation decreased. Rate, 20; volume, 3580 cc. per minute.		
3.08		34.7	15.8

In this experiment it was necessary to increase the air delivered by the pump more than 62 per cent in order to bring the blood oxygen to the level existing prior to the institution of artificial respiration.

Protocol 5.—EXP. D9. DOG; WT., 8 KG.

Time	Procedure and Respiratory Findings	Blood Volumes CO_2	Gases in Per Cent O_2
a.m. 11.12	Normal ventilation	48.4	14.8
p.m. 12.01	Normal ventilation. Rate, 34; volume, 1920 cc. per minute.		
12.03		49.6	
12.27	Curarization.		
12.28	Ventilation with lungmotor begun. Rate, 30; volume, 2220 cc. per minute.		
12.45		57.0	
12.48	Lungmotor ventilation increased. Rate, 20; volume, 3580 cc. per minute.		
1.10		42.8	
1.18	Lungmotor ventilation decreased. Rate, 15; volume, 2680 cc. per minute.		
1.43		46.9	15.8
2.02	Began introducing 10 cc. of artificial mucus into trachea at a rate of 1 cc. in 3 minutes. Animal prone.		
2.32		44.9	14.7

In this case, it is again evident that a ventilation comparable to that of the animal was inadequate to prevent CO_2 accumulation. With a practical doubling of the ventilation this was done, and later, under a 40 per cent increase over the original normal ventilation of the animal, obstruction to air flow was not sufficient to cause harm even though a fair amount of artificial mucus was introduced.

Protocol 6.—EXP. D5. DOG; WT., 17 KG.

Time	Procedure and Respiratory Findings	Blood Volumes CO_2	Gases in Per Cent O_2
a.m. 11.40	Normal ventilation.	36.1	15.8
p.m. 12.35	Normal ventilation.	40.0	
1.43	Normal ventilation. Rate, 38; volume, 4860 cc. per minute.		
1.48		38.1	
1.57	Curarization.		
1.59	Ventilation with lungmotor begun. Rate, 18; volume, 5090 cc. per minute.		
2.22		37.9	17.5
3.03		36.0	
3.14	Dog board tilted to angle of 17°. Began introducing 10 cc. of artificial mucus into trachea at a rate of 1 cc. in 3 minutes .		
3.32		45.7	4.6
3.36	Lungmotor ventilation increased. Rate, 18; volume, 7323 cc. per minute.		
3.43		34.4	
4.00	Lungmotor ventilation increased. Rate, 30; volume, 8480 cc. per minute.		
4.19		38.5	

In this experiment, serious asphyxia occurred after the introduction of a comparatively small amount of mucus, considering the size of the dog. The animal was in a head-down position at an angle of 17°. The obstruction was

laryngeal and in order to keep the animal alive it was necessary to increase the ventilation by 50 per cent.

The observer who first glances at these experiments will ask whether we have any assurance that conditions of blood flow were reasonably comparable during the preliminary period of natural ventilation and during the period of artificial respiration following curarization. It is highly probable that they were not. In our experience, curare is very apt to cause a fall in blood pressure in the dog, and the ventilation necessary after its use may well be somewhat different than before. But such a criticism is aside from the real situation under examination. The lungmotor operates at six different strokes and the rates at which one is directed to use these different strokes result in giving degrees of ventilation suitable for different sized individuals. Thus, the machine used by us gave the following results:

Stroke	Cc. of Air per Stroke	Rate per Minute Recommended	Volume per Minute in cc.
Infant	74	80	4440
5 years	179	26	4654
10 years	285	20	5660
15 years	408	20	8160
Adult, average	512	18	9216
Adult, large	650	18	11,700

These figures are intended to represent the amounts breathed by average healthy individuals, plus a certain margin. This margin would be adequate provided all the air delivered at the nozzle reached the lungs of the subject. But as the situation actually stands, the margin is, in our opinion, too small. The face mask provided leaks around the edges during the inspiratory stroke of the pump and, in addition, inflation of the cheeks and the pharynx results in a very considerable increase in dead space. Both of these facts—and the first of them is extremely variable—must be considered in providing basic directions for the use of positive ventilation apparatus. We may consider, therefore, that in patients upon whom the lungmotor is used the air actually available is very little, if at all, above the normal requirements for individuals in conditions of perfect health. When, however, we consider that the individual overcome by illuminating gas has a low blood pressure—indeed, if breathing has actually ceased, is in a condition demanding a decided increase over normal in the amount of air entering the alveoli—it is at once apparent that our experiments are not misplaced. They show that, in order to provide satisfactory positive pressure ventilation through a face mask for dogs whose breathing has been stopped by curare, one must use a nozzle delivery of much more air per minute than is called for by the animal under natural conditions of breathing, and this is the case even when there is no leakage around the face mask used. It is quite possible to maintain life with the lungmotor in such animals over long periods of time, provided the operator is a well-trained physiologist accustomed to watch for signs of impending disaster. Exactly the same situation is provided in the case of the pulmotor, Type B, where positive pressure and suction alternate at the will of the operator. Here, again, successful artificial respiration depends upon the employment of physiological experience and judgment.

B. Experiments on Men

In 1914, a report (14) of the Committee on Resuscitation from Mine Gases appeared in which the action of both

types of pulmotor and of the Brat apparatus was condemned "because repeated suction of air from the lungs is not physiological and if continued is likely to result in injury to the lungs and inadequate inflation." In 1916, Henderson (15) summarized the general situation in regard to artificial respiration. He condemns apparatus for artificial respiration but in the scope of his article is able to offer little either in regard to such devices or to manual methods of artificial respiration.

Meltzer (16), in 1917, after presenting a short summary of Keith's (17) historical account of resuscitation, discussed the matter of apparatus operating by positive pressure and suction. In this discussion Meltzer made a special point of the harm done by suction, citing numerous observations in which it had been shown that a repeated suction action gradually induces areas of lung collapse. Meltzer recommended the use of a simple positive pressure artificial respiration device in which expiration is passive. He felt that it had been established that any of the manual methods of artificial respiration were unequal to maintaining life for more than a short time.

Let us consider the manner in which these different conclusions have been reached, discussing, first, the last conclusion—namely, that artificial respiration by the Schäfer method is not equal to maintaining life in non-breathing human subjects. Schäfer (18) himself, in examinations upon normally breathing subjects, was able to obtain a ventilation of 520 cc. per respiration or 6760 cc. per minute. Other observers—very recently, for example, Burton-Opitz (19)—have been able to repeat this observation. It is, however, generally thought that such normal values as these merely reflect the cooperation of the subject, who breathes with the operator and involuntarily provides a normal ventilation. In order to make a better approach to the problem, Henderson (14) examined the respiratory exchange in men during the period of apnea which follows forced breathing. He found that the maximum amount of air which he could move with each respiration by the Schäfer method was 300 cc. Here again, however, evidence points to a certain degree of respiratory fixation during apnea which renders the situation quite abnormal.

Efforts to measure the amounts of ventilation obtained by various methods have been made upon the cadaver. Schäfer (18) reports upon the futility of attempting to make satisfactory tests upon the dead body, although he implies that in some cases the experiments were made soon after death. Liljestrand, Wollin and Nilsson (20), in a paper written in 1913, summarize the results of different types of manual artificial respiration applied to corpses and show that the ventilation obtained is usually insignificant.

We are, therefore, face to face with a situation in which no one has as yet made a valid experiment. We wish to know how much air can be moved per respiration by the Schäfer method in human beings who have stopped breathing but whose hearts are still beating. The proper experimental circumstances are not given by normally breathing persons, nor by apneic subjects, nor by cadavers. Yet confidence in manual methods has been shaken by published figures of the relatively small volumes of air moved by these methods, particularly in apneic subjects, even though the reasons for this appeared with the original figures. And this lack of confidence has been increased by the statements of Meltzer (14) (16) that the longest time which he was able to keep the heart beating in a curarized

dog by manual artificial respiration was 31 minutes.

Against these observations, we can only cite experiences which lack the actual measurements that are desirable. Dr. Harvey Cushing (21) for example, possesses records of a patient with a cerebellar tumor who stopped breathing and who was kept alive by artificial respiration for 48 minutes. At the end of this time, Dr. Cushing succeeded in tapping a cerebellar cyst and, upon relief of pressure, natural breathing began once more. This patient is alive and well today. In another case, Dr. Cushing's actual record is as follows:

M. McC.; female; aged 49.

Diagnosis, cerebellar cyst.

A history is given of symptoms extending back over a number of years and a physical examination pointing to a cerebellar tumor is recorded. The following note covers the occurrences during the first operation on March 6, 1909.

"The patient was placed in the usual cerebellar position. (This is a face-down position entirely favorable for the Schäfer method of artificial respiration.) The mere turning on her side necessary for exposure of the occipital region brought on one or two of the attacks previously described (periods of respiratory failure). The usual crossbow incision was made and the two lateral flaps were reflected, as is customary in this procedure. On carrying the muscle incision across the median line, a large vascular lake was opened and bled profusely. The extravasation was temporarily checked by pressure upon the vessel and finally by a combination of wax and cotton. It was subsequently shown that there was a large opening, possibly a centimeter in diameter, in the bone, practically at the region of the torcular, and it was from this opening that the bleeding occurred. At this stage in the operation and while this profuse bleeding was taking place, the patient suddenly ceased breathing. After a moment, the blood which was being lost became black and respiration was not resumed, whereupon the operator proceeded to make respiratory movements by artificial means, namely, by the Schäfer method, which was sufficiently successful to enable an exchange of air to take place to keep up fairly strong and regular contractions of the heart. The operator then proceeded with the operation, artificial respiration being continued by a number of the operating staff for the following forty-five minutes, until the herniated edges of the cerebellum were liberated, with a subsequent freeing from pressure, when spontaneous breathing was resumed."

During the period of artificial respiration, the pulse rate slowed from 120 to 80. The patient recovered satisfactorily from this exploration and, on April 9, a cerebellar cyst was evacuated. When heard from seven years later, she was alive and well.

Instances of this sort might be multiplied and constitute the most convincing sort of evidence that the manual method of artificial respiration will maintain not only an emergency type of ventilation for a few minutes but undergo the added strain of surgical manipulation. The commission consequently endorses the Schäfer method of artificial respiration with all the emphasis possible and calls attention to the fact that, although such emergencies as Dr. Cushing has met in these cases permit the instant application of devices like the lungmotor and pulmotor, the most experienced operators pre-

fer to rely upon the simpler and more satisfactory manual method.

The second general objection which has been advanced against such devices as the lungmotor and pulmotor is found in the production of expiration by suction. In our experiments we have not seen direct damage to the lung, as described by Meltzer (16) and are in agreement with Henderson (15) that, with anything like reasonable use, such changes will not be induced. We have, however, had some direct experiences with suction expiration which are of interest. Six workers in the laboratory, including ourselves, experienced the operation of the lungmotor during apnea following forced breathing. The face mask provided with the machine was used and was adjusted as carefully and as tightly as possible. It is held in place by a strap passing around the head and, in our experiments, was certainly adjusted with more care than would be usual in the emergencies which the apparatus is intended to meet. Ventilation was carried out in accordance with the directions provided with the instrument. On the inspiratory stroke, we were unable to drive more than a very small quantity of air into the chest unless the subject cooperated by breathing slightly. If he lay absolutely passive, the cheeks and the pharynx ballooned out and there was a large amount of leakage around the eyes and just below the malar bones. On the suction stroke which followed, this leakage was automatically partially sealed off, the skin of the cheeks and face being dragged tight against the rubber rim of the mask. As a result, the subject experienced an inspiration which did not affect the size of the chest, followed by an expiration which reduced it. After one or two of these expiratory sucks, he involuntarily broke through his apnea with an inspiration, which had no other purpose than the restoration of the lungs to mid position, since, if the apparatus were removed at this point, apnea would continue for a normal period of time. The experiment offers a very interesting demonstration of the nervous mechanism of respiration and shows the readiness with which apparatus operating through suction may reduce the mid volume of the thorax.

It will always be a difficult matter to make a face mask which can be adjusted rapidly and which will stand the positive pressure necessary to drive air into the lungs past the manifold obstructions which may be met. When such a device as the lungmotor is used in animal experimentation, a face mask is employed which is actually air-tight. This will rarely or never be the case with human subjects.

The lungmotor used by us withdrew less air on the expiratory side than was delivered by the inspiratory pump. The difference, however, was not great enough. In the hand-controlled pulmotor, the operator is supposed to regulate the degree of suction applied in expiration. The extreme subtlety of the entire situation, however, coupled with the rapidity with which adjustments must be made, render it improbable that this can ever be done correctly. What actually happens, in terms of positive and negative pressures, is well illustrated in an experiment of ours performed upon a muscular man, aged 50, weight 175 lbs., who died of methyl alcohol poisoning at 3.25 p. m. At 4.43, the body being still warm and showing no evidence of *rigor mortis,* we applied the lungmotor, using the ordinary mask and fitting it as carefully as possible. The following pressures in millimeters of Hg were obtained in a series of strokes:

Negative Pressure	Positive Pressure
3.0	3.2
5.0	3.4
8.4	1.2
10.4	6.2
12.4	5.2
6.4	4.2
10.4	7.0

In this instance, no air seemed to enter the chest. The cheeks ballooned out, a certain amount of compression occurred, and most of the air escaped around the mask. When the mask was rendered less leaky by holding its margins firmly with the fingers, we forced air into the stomach but very little, if any, into the chest. With the Schäfer method of artificial respiration, we were unable to secure any ventilation whatsoever.

In another instance—a woman aged 33, of moderate size, dead 1 hour and 43 minutes from pernicious anemia—we secured what seemed to be excellent ventilation with the lungmotor when the mask was held tight by hand. In this case, when prone pressure artificial respiration was tried the first three or four efforts gave a ventilation of 100 cc. per respiration. This speedily fell to 50 cc. per respiration and soon no air movement at all occurred. The operator felt as though he had gradually deflated a rather resistant and totally inelastic cushion and that when all the air had been forced out and the chest reduced to the smallest possible volume, no further result could be obtained.

Manual methods of artificial respiration depend equally upon the operator and upon the elastic recoil of the body tissues. This latter element is lost rapidly after the heart stops beating. From the point of view of artificial respiration, the dead body is transformed from the condition represented by a partially inflated, stiff-walled rubber bag to that of a bag of wet linen containing a slight amount of air by virtue of the stiffness of its walls. In either of these cases, air can be blown in and sucked out but, in the second case, there is no possibility of moving air by rhythmic compression and relaxation of the bag.

Conclusions

1. The possibility that acute cardiac dilation and failure of the right ventricle may occur in subjects poisoned by illuminating gas as a result of excessive artificial respiration by positive pressure apparatus (pulmotor and lungmotor) has been tested upon cats. In these experiments, ventilation was maintained through a tracheal cannula in order to be sure that the alveoli were reached by the extreme amounts of air utilized. No harm was done the heart and this objection to positive ventilation apparatus is removed.

2. In a series of experiments upon dogs and cats in which the factor of gravity was excluded, it has been shown that material dripped into the trachea is carried to the lungs by positive pressure ventilation. These experiments substantiate the possibility that distribution of infected mucus and vomitus by blasts of air from positive pressure apparatus may be concerned in the frequent occurrence of bronchopneumonia following gas poisoning.

3. A. When respiration in dogs is stopped by curare, it is necessary, in order to maintain life with the lungmotor, even though a non-leaky face mask is used, to set the apparatus so as to deliver a greater volume of air per minute than is represented by the natural respiration of the animal before curarization. This necessity is due, in these experiments, to the large increase in dead space incident upon inflation of the dog's cheeks and pharynx and to the minor obstructions to the air blast which frequently occur.

In the hands of persons familiar with the physiology of respiration, the instrument can always be adapted to supply a sufficient amount of air. It is not serviceable in terms of simple fixed instructions but must be operated by persons capable of adapting it promptly to the needs of the victim.

B. It is shown that no evidence as yet exists by which we can evaluate manual methods of artificial respiration in satisfactory physiological terms. The probabilities are that the Schäfer method is much more efficacious than is ordinarily believed.

The difficulty of obtaining a tightly fitting face mask for human use is discussed and the consequences of using a leaky one are pointed out. If the mask leaks, it is invariably somewhat sealed off during the suction period which accomplishes expiration. As a consequence, suction becomes more effective than blowing and the size of the chest is steadily reduced.

Finally, an account is given of attempts at artificial respiration on the bodies of persons, dead but a short time, and the impossibility of obtaining data upon the efficiency of manual methods from such experiments is confirmed.

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REPORT NO. 3

Wireless Message on Prone Pressure Method of Resuscitation

The American Gas Association, the National Electric Light Association and the National Safety Council have requested (Name of Broadcasting Station) to transmit the following information on Resuscitation:

Many persons meet death every year by drowning, by poisonous fumes or by electric shock, when a few simple measures would have saved their lives.

The victims are seldom killed outright, and only need to have their breathing restored artificially.

Listen closely, and we will tell you how to produce artificial respiration, and we will repeat the instructions so that you will be sure to get them:

Start treatment immediately, and as near the scene of the accident as possible.

Lay victim on stomach—face to one side—arms extended straight forward.

Now kneel—straddling victim—well below the waist—facing toward his head. Place your hands on small of victim's back—just above hips and touching lowest ribs.

With arms straight—swing forward slowly—bring your weight to bear upon the victim—gradually but not violently—for about three seconds.

Then swing back to original position, releasing your weight.

Repeat operation about twelve times a minute or at rate you yourself breathe.

All you do in these instructions is to force air out of the lungs when you exert pressure, and when you release pressure the air flows back itself.

The victim will usually show signs of returning life within a half hour, but, if not, continue as long as four hours.

Do not move him until he is breathing normally without assistance; then use a stretcher keeping him warm and in bed for several hours.

Learn this method yourself. Delays are fatal. Do not leave the patient until breathing is restored. Death is the frequent result of efforts to send for help. If you have mastered this method of artificial respiration you have in your own power the best means of reviving the patient. Try it on your friend, and have him try it on you now.

Now we will repeat the instructions:

Lay victim on stomach—face to one side—arms extended straight forward.

Now kneel—straddling victim—well below the waist—facing toward his head.

Place your hands on small of victim's back—just above hips and touching lowest ribs.

With arms straight—swing forward slowly—bring your weight to bear upon the victim—gradually but not violently—for about three seconds.

Then swing back to original position, releasing your weight.

Repeat the operation about twelve times a minute or at rate you yourself breathe.

The victim will usually show signs of returning life within a half hour, but, if not, continue as long as four hours. Do not move him until he is breathing normally without assistance; then use a stretcher keeping him warm and in bed for several hours.

REPORT NO. 4

Communications Creating "The American Gas Association's Meritorious Service Medal"

COPY

Walter R. Addicks
130 East 15th Street
New York

May 10, 1923.

To the President and Board of Directors,
The American Gas Association,
342 Madison Avenue, New York City.

Dear Sirs:

At the suggestion of the American Gas Association's Accident Prevention Committee, most deeply interested in the promotion of safe service in the gas industry, I tender a medal that if deemed suitable by your Board, shall be designated the "American Gas Association's Meritorious Service Medal" the "reverse" to be so inscribed with the name of the recipient and the date of the occurrence that prompted the award. The "obverse" to have a suitable figure and inscription indicating the significance of the medal.

Accompanying the medal should be a statement setting forth the salient facts

that justified an award, a copy of the resolution of the Board that authorized the award which should be signed by the President of the Association and attested by its Secretary.

In tendering this medal I deem that the following qualifications would be appropriate:

1. Not more than one medal to be awarded annually for a period covered by the prior calendar year,—provided a meritorious act was performed.

2. Award by and with the authority of the Board of Directors as now constituted or any successor governing body of the American Gas Association, or its successor.

3. Only to one who has shown meritorious and conspicuous judgment, intelligence or bravery in saving human life either in the plant or works of any gas undertaking or having to do with the handling of the materials of manufacture or of the products manufactured or distributed.

4. Any loyal citizen of the United States, without regard to age, sex, race, religion or political affiliation shall be eligible for an award, provided, however, he was at the time of the occurrence regularly in the employ of, or an officer of, a Member Company, or was at the time an active or an associate member of the American Gas Association or of its successor.

5. An award may be made, if the Board of Directors so order, in memory of one who, if surviving, would have received such award provided there be a widow, son, or daughter surviving, to receive custody of such award.

6. The Directors of the American Gas Association may at any stated meeting make any regulation or requirement governing an award not inconsistent with the foregoing requirements.

I would say in closing that this tender is made with the hope that the motive is fully understood to be that outlined in the opening paragraph of this letter.

I am,

Very truly yours,
(Signed) W. R. Addicks

From Minutes of Executive Board
Meeting Held in Atlantic City,
June 1, 1923

A. G. A. Meritorious Service Medal:

The Secretary-Manager read a letter from Mr. Walter R. Addicks, in which he tendered a medal to be designated as the American Gas Association's Meritorious Service Medal and which will be awarded annually through the Accident Prevention Committee in recognition of a meritorious act. The Board voted to accept Mr. Addick's offer and authorized the officers to take such action as to conform to his deed of gift. The Secretary-Manager was instructed to write Mr. Addicks a letter of appreciation and acceptance of his generous offer.

COPY

June 7, 1923.

Mr. Walter R. Addicks,
130 East 15th Street,
New York, N. Y.

Dear Mr. Addicks:

I desire to advise you that at the meeting of our Executive Board held in Atlantic City on June 1, there was presented your letter of May 10th transmitting a very generous offer to provide a medal, to be known as "The American Gas Association's Meritorious Service Medal."

All of the conditions governing the award of this medal as set forth in your

communication were acceptable and in full harmony with the rules under which the Association has decided it can properly undertake the administration of awards of this character. Consequently, your offer was accepted and I am directed to express to you the appreciation and thanks of our Executive Board.

Very truly yours,
(Signed) Oscar H. Fogg
Secretary-Manager.

REPORT NO. 5

Statistics in Regard to Deaths from Manufactured Gas Poisoning

This sub-committee was appointed for the purpose of gathering data in regard to deaths from manufactured gas poisoning, in order that the Accident Prevention Committee might determine the general causes of accidental deaths and thus be able to take such steps as would be thought advisable, to eliminate them.

Requests for information were made to a number of companies throughout the United States and we were successful in gathering certain data which we believe exemplify typical conditions throughout the country.

In gathering the information we decided to take figures applying to the year 1922, as the data so collected would represent results obtained under present day safety methods and with the most up-to-date apparatus.

The attached table gives a summary of the information collected.

From the table it is seen that out of a total of 1,100 deaths 791 or 71.9% were suicides and 309 or 28.1% were accidents. Of the 309 accidental deaths, no detail was given in 258 cases, and it is not certain that all of these deaths were accidental.

The table, while showing the excellent record of the gas companies in the past year, also serves the purpose of calling our attention to the types of accidents which still cause a number of deaths, and toward the elimination of which we should lend all possible aid.

TABLE SHOWING DEATHS FROM MANUFACTURED GAS POISONING DURING THE YEAR 1922

	Total Deaths	Sui-cides	Acci-dents	No details* No record**	ACCIDENTS: Open Cocks, Burners, Etc.	Burns	Broken Mains, & Connections, Leaks	Defective Apparatus	Discon-nected Tube	Explos-ions	CO_2 poisoning from open burners
Washington Gas Light Co., Washington, D. C.	15	7	8	—	5	1	—	1	1	—	—
Denver Gas & Electric Light Co. Denver, Colo.	6	6	—	—	—	—	—	—	—	—	—
New York City Consolidated Gas Co. of N. Y.,	456	451	5	—	—	—	2	1(f)	2	—	—
Milwaukee Gas Light Co. Milwaukee, Wis.	22	10	12(a)	6**	3	1	—	—	2	—	—
The United Gas Imp. Co., Philadelphia, Pa.	108	103	5	—	—	5(b)	—	—	—	—	—
Kings County Lighting Co., Brooklyn, N. Y.	7	2	5	—	2(e)	2(c)	—	—	1(d)	—	—
Detroit City Gas Co., Detroit, Mich.	21	4	17	10*	—	—	3	1	1	—	2
Brooklyn Union Gas Co., Brooklyn, N. Y.	89	37	52	52*	—	—	—	—	—	—	—
The Peoples Gas Light & Coke Co. Chicago, Ill.	331	145	186	186*	—	—	—	—	—	—	—
Southern California Gas Co., Los Angeles, Cal.	4	—	4	—	—	2	—	—	—	2	—
Laclede Gas Light Co., St. Louis, Mo.	41	26	15	4*	7	—	—	1	1	—	2
Total	1100	791	309	258	17	11	5	4	8	2	4

(a) Included 3 children, 3 called, "probably accidental."
(b) Company claimed 2 of these due to coal gas from heater.
(c) 1 of these caused by explosion of still.
(d) Police thought this due to wood alcohol poison.
(e) 1 probably accidental.
(f) Defective tubing.

REPORT NO. 6

Outline of Proposed Organization for Coordination of Public Utilities Safety Work

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First NAME

This proposed co-ordination to be brought about by means of a body to be known as the "Public Utilities Advisory Board."

Second OBJECT

The aims and objects of this Board shall be, as the name implies, to consider such problems as are common to the various interests represented, and to make such recommendations to the interests represented on the Board as will result in the greatest possible co-ordination of the safety work being carried on by the various Utility Associations and other safety agencies, to the end that insofar as Public Utilities are concerned the maximum of safety may be secured in these industries and in the communities in which they serve.

Third PERSONNEL

This Advisory Board to be comprised of the following,—Representative—National Safety Council, to be appointed by the President of the Council.

Chairman—Accident Prevention Committee—National Electric Light Association.

Chairman—Accident Prevention Committee—American Gas Association.

Chairman—Accident Prevention Committee—American Electric Railway Association.

Representative—American Telephone and Telegraph Company.

Chairman—Accident Prevention Committee—American Railway Association.

Fourth

Each of the above members of this Board to be provided with an alternate appointed from their respective Accident Prevention Committees or by the National Safety Council and the American Telephone and Telegraph Company.

Fifth

Each alternate to serve with full power at any meeting of the Board in case the official representative of his organization cannot be present.

Sixth

The Advisory Board to have the power to extend a call to representatives of other Associations or Organizations who may have an interest in any particular matter to come before any particuluar meeting.

Seventh OFFICERS

The officers of this Board shall consist of a Chairman and Secretary. The former shall be elected from and by the Board. The Secretary shall be appointed by the Chairman of the Board from within or without the Board's membership.

Eighth BY-LAWS

At its first meeting the Board shall appoint a Committee on By-Laws, who shall

report at the next meeting. These by-laws before being passed by the Board, shall be submitted to the various interests represented on the Board for their suggestions and criticism, to the end that maximum co-ordination in carrying on Public Utilities Safety Work may be secured within the least possible time.

Ninth ROUTINE

Matters of joint interest to all Utilities to be subject to discussion before the Advisory Board and the Chairman to recommend to the National Safety Council its action or endorsement where the Board deems such desirable in the interests of Public Safety.

Tenth

Matters originating in any Association Committee of interest to other interests represented on the Advisory Board to be referred to the Board for consideration and it in turn to report back to all the interests such recommendations as may seem proper.

Eleventh

Reports of all Accident Prevention Committees to be sent to all members of the Advisory Board.

REPORT NO. 7

Accident Prevention Committee—Organization and Duties

For the purpose of rendering the Accident Prevention Committee of maximum usefulness to the membership of the Association the following form of organization and schedule of duties has been adopted:

Chairman in general charge, and member with alternate on Co-ordination Committee of Public Utilities Safety Work.

Vice Chairman in general charge due to absence or disability of Chairman.

Secretary in charge of all records and minutes. Each member of the Committee and Secretary-Manager of the Association to receive a copy of all minutes.

Standing Committee:

1. Statistical Committee to secure standard data on accidents to Public and Employes.

2. Publicity Committee to advise as to best means both generally and in specific instances regarding promotion of good and minimizing of harmful publicity. Committee to advertise services available to membership of Association through Accident Prevention Committee.

3. Clearing House Committee on Bulletins on all accidents of very serious nature.

4. Publication Committee—Annual Report, Resuscitation Booklets, etc.

5. Committee on Examination of Safety Devices.

The Accident Prevention Committee is a general one, and all matters having to do with accidents within the Association's organization are automatically brought to the Committee's attention through the Secretary-Manager of the Association.

It is responsible for the stimulation of new knowledge, the propagation of standard and special information, the co-ordination of safety work within the Association, and the rendering of special service.

New sub-committees may and should be formed from time to time as need arises.

Not less than four, and not more than six, regular meetings should be held annually.

It is the duty of each member to keep up a continuous survey of the safety field in general, and in his own province especially, bring to the Committee's attention matters affecting the welfare of the Safety Movement in the Industry.

(Motion made, seconded and carried that the report of the Accident Prevention Committee be accepted and printed in the Proceedings.)

REPORT OF COMMITTEE ON GAS STANDARDS AND SERVICE

J. B. Klumpp, *Chairman,* Philadelphia, Pa.

The Committee on Gas Standards and Service, which superseded the Committee on Calorific Standards, was established in October, 1922. It fulfilled the need of a Committee which should have a wider scope than was covered by the Committee on Calorific Standards, and therefore embraces all matters of gas standards and their effect upon service.

Organization of the Committee

The nucleus of the Committee consists of members at large from the American Gas Association. Added thereto is one representative from each of the affiliated associations, preferably the chairman of the committee, with jurisdiction over standards matters. Sub-committees of the main committee have been appointed to deal with those regulations that specifically define certain conditions to which the operating companies must conform.

Scope of Committee's Work

In general, it is planned that the Committee should cover the entire field of gas standards and the effects of standards upon service. Its work should aid in the establishment of standards on a basis affording the best service to consumers without unnecessarily restricting the operation and development of the gas industry.

Program for Committee as a Whole

The committee as a whole shall have general jurisdiction over the program relating to standards of service of the American Gas Association. It shall act as a co-ordinating agent and bureau of information regarding gas standards for the affiliated associations and it shall receive and approve reports of the subcommittees.

Program of Sub-Committees

In order to deal with certain specified regulations, sub-committees have been appointed on Heating Value Standards, Meter Requirements, Pressure Requirements, Gravity and Inerts, Purity and Chemical Requirements, and Main Extensions and Miscellaneous Service Rules. These sub-committees are expected to make an intimate study of the principles underlying these matters and to report to the committee as a whole any recommendations as to advisable changes in such rules now in effect, together with such data, information, etc., which seems essential to a proper understanding on the part of the industry or the commissions as to the reasons underlying such recommendations. This policy, it is expected, will be worked out by these various sub-committees along the following lines:

a. What is practical from the standpoint of actual operation in order to

discourage unduly restrictive specifications.

b. To discourage those specifications, which to comply with would cost more than the benefits secured would warrant.

c. Economic consideration related to local supply of raw materials.

d. Necessary elasticity of specifications which will not preclude particular processes of manufacture, the present or future use of which are necessary or desirable from an economic standpoint.

e. Any additional local considerations which would call for a modification of certain rules in the interests of both consumer and the company.

Program Suggested to Committees of Affiliated Associations

These local committees should handle all matters pertaining to the formation or changes of standards arising in their jurisdiction, with such assistance or data as they may require from the A. G. A. Committee. The affiliated representative on the A. G. A. Committee should keep that Committee advised of any developments relating to standards in his territory and to advise of any proposed action in sufficient time before it is presented to the regulatory body so that the A. G. A. Committee may make any seemingly desirable suggestions from the standpoint of the whole industry. The local Committees should also be utilized to furnish necessary data as to local conditions, processes of manufacture, supply of raw materials, etc., as may be essential to the study of proper standards of service which is being made by the A. G. A. sub-committees.

Work Accomplished

Corrected sets of the rules of all State regulatory bodies, classified according to the particular field assigned to each of the sub-committees, have been prepared and all members of the committee at large, and of the sub-committees have received complete sets of these rules.. In addition, complete sets of the rules have been sent to each of the State regulatory bodies, as a means of checking the material and also as a matter of courtesy. Also the Committee prepared a statement commenting upon the tentative gas standards rules of the State of Michigan.

The Sub-committee on Heating Value Standards is working on a comprehensive program which contains the following items:

1. A study of existing Rules and Regulations having in mind the elimination of undesirable specifications.

2. A study of the physical characteristics of various gases, and all data relating to the efficiency of utilization of various gases.

3. A study of the effects following the distribution of gases of lower heating value.

4. A study of economic conditions which have a bearing on the heating value to be supplied in particular localities.

The work of this sub-committee will not be completed by the end of the year, in fact it may be several years before it finally reports. However, when its work is completed, it is expected that the results will be of great value to the industry.

The work of the Sub-committee on Gravity and Inerts is progressing actively. This sub-committee is collecting much valuable data on the effect of changes in gravity upon service, and hopes to issue, through the committee at large, brief directions dealing with appliance ad-

justments, pressure changes, etc., to be followed by gas companies when changing from coal to water gas, or vice versa. This sub-committee will be unable to complete its work by the end of the year, but it is felt that the information eventually to be obtained will be of great value to the industry from an educational standpoint.

The remainder of the sub-committees have planned or are planning their work along comprehensive lines, and it is expected that the results of the work of all of these sub-committees, when completed, will be of great assistance to regulatory authorities in drafting reasonable and just regulations.

Recommendations

It is recommended that the organization of the Committee be continued at least for another year, so as not to destroy the continuity of the work already undertaken.

The enforced education of the gas industry itself, respecting gas standards, would appear to be one of the most pressing, as well as important, activities of the Committee. This applies especially in those localities where the need of additional supplies of gas for house heating and industrial purposes may become acute, and where the maintenance of good service becomes a serious problem.

It would appear to be a wise policy to first inform ourselves of all matters pertaining to gas standards and to be able to support such knowledge with facts. If we are thus equipped, and the need arises, much can be accomplished with regulatory bodies to discourage, in a large measure, the inclusion of inadvisable specifications in proposed rules.

To so equip ourselves, however, requires a knowledge of the experience of others, and, therefore, each of us should be willing to make available to the industry such facts as we may possess. Since the Committee is endeavoring to collate all matters pertaining to standards in order to supply the industry with the necessary information, it should receive complete co-operation from all companies or individuals in the industry. If the Committee is properly supported, it should become of the greatest importance, as well as of the greatest usefulness, to the industry.

(Motion duly made, seconded, and carried that the report of the Committee on Gas Standards and Service be accepted and printed in the Proceedings.)

REPORT OF GAS SAFETY CODE COMMITTEE

W. R. Addicks, *Chairman,* New York, N. Y.

It has been suggested to me by your Secretary-Manager, Col. Fogg, that the members would like to have specific and definite information as to the present status of the Gas Code and in what form the Code will be issued.

There will be printed with this short statement "An Historical Account of the Gas Safety Code from its Inception." In this will appear the names of all those who have had to do with the code at any time. To all of these gentlemen the membership of the Association is indebted for a great deal of careful review and criticism.

The code submitted to your committee as originally prepared by the Bureau of Standards covered Manufacture, Distribution, Gas Fitting, Appliance Design and Appliance Installation.

It has been thought best to combine the last three, "Gas Fitting, Appliance Design and Appliance Installation," in a code, the subject matter including as it does all installations on the consumers' premises. This code will interest architects, insurance interests, plumbers and gas fitters and public authorities.

Later a code may be found advisable, if you gentlemen wish it, for the guidance of the gas engineer or superintendent having charge of manufacture and distribution.

The code has been in preparation since prior to the world war, which interrupted the active preparation for several years.

The code as prepared by the Bureau of Standards was criticized by your code committee, consisting of sixteen members selected as representative of the entire industry.

The chairman then appointed a sub-committee selected from the code committee membership, with Mr. R. S. Doull as Secretary, to consider the criticisms of the code made by the several members of the full committee. Mr. Doull under the instructions of the sub-committee prepared an amended code. While this work was in progress one of the members of the code committee, Mr. William J. Serrill of Philadelphia, suggested an entire change in the form and make-up of the code, bringing it more in line with the modern code make-up advocated by the American Engineering Standards Committee. Mr. Serrill's work immediately appealed to the membership of the code sub-committee and Mr. Serrill was appointed chairman of a special committee to consider his code plan. After Mr. Serrill's code form had been considered and amended, the two codes, that prepared by Mr. Doull under the sub-committee's direction and that prepared by Mr. Serrill's special committee, were placed before the sub-committee for consideration.

It was the unanimous opinion of the sub-committee, the Bureau of Standards

representatives concurring, that Mr. Serrill's code plan was the better and the sub-committee voted to perfect that code and drop the original form.

The final code was printed and while at this writing tentative in every way, is now in the hands of the full committee membership for consideration on Friday, October 19, at ten o'clock.

What their action on the code will be remains to be seen.

For the benefit of the membership not informed on the modern method of code construction I may add the following:

Your Association and the Bureau of Standards are co-sponsors for the preparation of the gas code under the supervision of the American Engineering Standards Committee. The latter has appointed a national committee on the Gas Safety Code.

Your Association has but five representatives on this committee in a membership of twenty-eight. The other associations represented being:

American Institute of Architects,
American Society of Safety Engineers,
Association Factory Mutual Fire Insurance Companies,
Bureau of Mines,
Bureau of Standards,
Compressed Gas Manufacturers Assn.,
International Association of Industrial Accident Boards and Commissions,
National Association Master Plumbers,
National Board Casualty & Surety Underwriters,
National Fire Protection Association,
National Safety Council,
Natural Gas Association,
Underwriters Laboratories,
U. S. Department of Labor,
U. S. Public Health Service,
National Electric Light Association,
National Association of Railway and Utilities Commissioners.

If and when the co-sponsors for the gas code, to wit: the Bureau of Standards and the American Gas Association; i.e., your directors and not your code committee in my view, are satisfied with the gas code in form and substance, it is in order to submit this code, still in the tentative form and subject to further amendment, to the national committee appointed by the American Engineering Standards Committee, and if and when the national committee approves of the form and substance in the code it is then in order for the American Engineering Standards Committee to adopt the gas code as a national code.

I suppose it is hardly necessary for me to add that no one can reasonably be expected to be entirely satisfied with all parts of the code. The task of preparing a code seemed too great an undertaking for any body of men actively employed on business affairs and unable to devote their entire time to it.

The code as now framed consists of a few fundamental rules which it might reasonably be expected could be embodied in local ordinances. Simple discussion of the reasons for each rule follows. Then follow specifications relating to pipes and appliances and installation which are, and must always be, subject to alteration and modification to keep pace with the progress in the industry.

Many of you will feel that the gas industry, that has prided itself on its care and thoroughness in the proper and safe conduct of its business for more than a century, needs no code; again many will feel as a writer must have felt when he wrote in the current issue of a prominent farm paper*:

"We are paying too much money for the privilege of being governed, inspected, advised and directed."

*The Rural New Yorker, Oct. 13, 1923, page 1922.

But let us congratulate ourselves that a code was not promptly put in effect years ago as was then intended, for the progress in our industry, particularly industrial, has been so pronounced, that any code that might have been adopted before the war would today be most inadequate and unworkable.

November 5, 1923

ADDENDA

A meeting of the whole committee of the A. G. A. Sectional Committee on Gas Safety Code was held on Friday, October 19, at 10 o'clock at Atlantic City. There were present:

R. G. Griswold, E. H. Earnshaw, J. D. Von Maur, J. I. Vincent, R. B. Harper, G. S. Barrows, W. G. Gribbel, Dr. J. F. Wing, W. J. Serrill, A. B. Macbeth, represented by F. J. Schafer; Hilmar Papst; George Wehrle, represented by R. G. Griswold; A. H. Hall; R. S. Doull; E. R. Weaver, representing the Bureau of Standards; W. R. Addicks, (Chairman).

An Executive Committee with the full power of the committee was appointed consisting of:

E. H. Earnshaw, R. G. Griswold, A. H. Hall, W. J. Serrill, W. R. Addicks, (Chairman).

Many amendments to the code were suggested, and each member was requested to file his suggestions in writing with the secretary.

A meeting was held at the Bureau of Standards on Monday, October 22, at 10 o'clock where the members of the committee and representatives of the manufacturers of gas appliances received a hearty welcome from Dr. W. A. Hillebrand, acting for Director Burgess who was unavoidably absent. This meeting was presided over by Mr. E. R. Weaver of the Bureau of Standards, and there were present:

R. G. Griswold, New York; J. D. Von Maur, Missouri; R. B. Harper, Illinois; G. S. Barrows, Rhode Island; Dr. J. F. Wing, Massachusetts; W. J. Serrill, Philadelphia; A. B. Macbeth, California, represented by Mr. F. J. Schafer; Geo. Wehrle, Colorado, represented by Mr. R. G. Griswold; W. R. Addicks, New York; A. H. Hall, New York; R. S. Doull, New York; E. R. Weaver, J. V. Brumbaugh, Dr. M. G. Lloyd, representing Bureau of Standards, Washington, D. C.; N. T. Sellman, representing A. G. A. Sec'y.-Mgr.; W. T. Rasch, Engineer of Utilization, Consolidated Gas Co. of N. Y.; C. C. Winterstein, United Gas Imp. Co., Phila.; A. B. Schall, Detroit Stove Works, Detroit, Mich.; E. V. Daily, Jas. B. Clow & Sons, Chicago, Ill.; A. Friedman, Cleveland Heater Co., Cleveland, O.; E. P. Bailey, Jr., Bryant Heater & Mfg. Company; W. W. Penn, Jas. B. Clow & Sons, Chicago, Ill.

The following, though invited, were not present:

L. B. Young, Michigan Stove Co., Detroit, Mich.; A. H. Humphrey, General Gas Light Company, N. Y.; H. W. O'Dowd, Wm. M. Crane Company, New York; E. H. Earnshaw, New Jersey; R. C. Congdon, Georgia; Hilmar Papst, Oregon; W. G. Gribbel, Pennsylvania; G. I. Vincent, New York; R. B. Brown, Wisconsin; J D. Taylor, Baltimore Gas Appliance Co., Baltimore, Md.; W. E. Derwent, Geo. D. Roper Corp., Rockford, Ill.; R. S. Wood, Secy. Nat. Assoc. of Stove Manufacturers, New York; W. C. Lindemann, Lindemann & Hoverson Co., Milwaukee, Wisconsin; Bertrand Kahn, Estate Stove Co., Hamilton, Ohio; Emmet Dwyer, Michigan Stove Co., Detroit, Mich.

Mr. Doull was appointed Secretary of this meeting.

Gentlemen representing the manufacture of gas appliances were requested to file with the secretary, at their early convenience, their criticisms and suggestions with respect to the code.

HISTORICAL ACCOUNT OF THE GAS CODE FROM ITS INCEPTION

American Gas Institute:

During 1913 and 1914 there appeared to be considerable interest on the part of municipal authorities in several sections of the United States as to the desirability of mandatory legislation, municipal and state, requiring the use of automatic shut-offs on the gas supply lines to buildings. In some localities the gas men from past experience knew the aims and purposes of the agitation, but in other localities the gas men were faced with an entirely new development. All of these men, desiring to be thoroughly informed upon the latest developments of the automatic shut-off agitation, and of the result of the use of automatic shut-offs where they had been installed, communicated with the American Gas Institute headquarters asking for data. These inquiries were referred to the Public Relations Committee and it being apparent that the general information available must be supplemented to be of service to the American Gas Institute members, the Public Relations Committee, through its Chairman, Hon. George B. Cortelyou, on February 5, 1915, appointed:

Messrs. G. S. Barrows, E. G. Cowdery, J. D. Von Maur, W. A. Wood, J. B. Klumpp, W. R. Addicks, Chairman, a "Committee on Automatic Shut-offs."

As this Committee on Automatic Shut-offs prosecuted its work it soon became apparent that to endeavor to confine its activities to the investigation of automatic shut-off alone would leave undetermined correlated subjects which were pressing for attention at the same time and consequently it was deemed desirable to enlarge the scope of the committee's work; therefore, the name of the committee was changed on June 10, 1915, to "Code Committee" and the purpose of the committee correspondingly expanded.

Later, July 13, 1915, Mr. Cortelyou, Chairman of the Public Relations Committee, appointed:

Messrs. G. S. Barrows, C. M. Cohn, E. G. Cowdery, J. B. Douglas, O. H. Fogg, J. B. Klumpp, F. E. Luther, C. E. Reinicker, W. J. Serrill, J. D. Von Maur, W. A. Wood, W R. Addicks, Chairman, a new committee known as the "Committee on Installation, Regulation and Safety Code," to take the place of heretofore existing committees known as "Committee on Automatic Shut-off Valves," the "Committee to Represent the Institute with the National Fire Protection Association in Connection with the Preparation of a Safety Code," and "Committee to Represent the Institute with the Bureau of Standards, Washington, D. C. in the Preparation of a Safety Code." The name of this new Committee was later changed to "Committee on National Gas Safety Code."

Reports of the work of the committee were made by Mr. Addicks at directors' meetings of the American Gas Institute, on December 9, 1915, January 13, 1916, and March 22, 1916; and on July 19, 1916, Mr. Addicks made a progress report to Mr. Cortelyou, Chairman, Public Relations Committee.

At the annual meeting of the American Gas Institute held in Chicago on October 17-20, 1916, Mr. Addicks submitted a report (see Note) in which was given the complete personnel of the committee, the steps taken to form this committee, the procedure followed for the development of the code, and a statement of the status of the work as of that date.

To quote from report:

Procedure:

On December 3, and 4, 1915, the first formal conference with the Board of Advisory Engineers was held at the Bureau of Standards, Washington, D. C.

At this conference a preliminary plan and scope of the proposed National Gas Safety Code prepared by the Bureau of Standards was presented.

The discussion of this plan and scope developed the desirability of preparing at once that portion of the code pertaining to the installation of fixtures and appliances.

From further discussion it appeared preferable that the work of preparing the rules be done by the Bureau of Standards and that the tentative rules then be submitted to the Board of Advisory Engineers.

As a result of this the Bureau of Standards prepared and submitted to the Board of Advisory Engineers, Part Four (Gas Fitting and Appliance Installation) and a second conference was held at the Bureau of Standards, February 23, and 24, 1916.

The two days assigned for this conference, however, were not sufficient to cover the entire matter prepared by the Bureau and only three sections (40-41 and 42) were considered.

It was found necessary to rewrite parts of the sections which were discussed. This was done by the Bureau of Standards and a third conference with the Board of Advisory Engineers was held at the Bureau of Standards, April 6 and 7, 1916.

Part Four was considered in detail, section by section, and the major portion of it tentatively agreed to by all those attending the conference.

May 12, the Bureau of Standards submitted copies of Part Four for distribution to the members of the Committee on National Gas Safety Code, who were appointed to consider that part of the code.

May 18, sufficient copies of this part were sent Messrs. W. A. Wood, Paul Doty and H. M. Papst, Chairmen of the Committees of Gas Fitting and Appliance Installation for the Eastern, Central and Western sections respectively, for each member of his committee. These were in turn distributed by the chairmen to the members for their criticism and suggestions. Replies from practically all the members have been received by the several chairmen and Mr. Wood's committee has made its report.

The preliminary plan and scope divided the proposed code into five parts, namely:

Part 1. General and Production of Gas.

Part 2. Distribution of Gas.

Part 3. Design and Construction of Gas Consuming Appliances.

Part 4. Gas Fitting and Appliance Installation.

Part 5. Information for Users of Gas.

But further consideration convinced the Bureau of Standards that additional divisions were advisable.

On April 11, the Bureau presented a revised plan and scope, in which the code is to be made up of ten parts.

April 28, 1916, copies of this revised plan and scope were sent to all chairmen for distribution to the members of their committees and the work among the various committees has been assigned according to this revised plan and scope as follows:

(Note: This report was published in American Gas Institute Proceedings, Vol. XI, Part II, 1916, pages 1147 to 1154 inc.)

Part 1. MANUFACTURE: Assigned to Committee on General and Production of Gas.

Part 2. DISTRIBUTION: Assigned to Committee on Distribution of Gas.

Part 3. APPLIANCE DESIGN: Assigned to Committee on Design and Construction of Gas Consuming Appliances.

Part 4. GAS FITTING: Assigned to Committee on Gas Fitting and Appliance Installation.

Part 5. APPLIANCE INSTALLATION: Assigned to Committee on Gas Fitting and Appliance Installation.

Part 6. NATURAL GAS WELLS AND FIELD STATIONS: Assigned to Committee on Distribution of Gas.

Part 7. ACETYLENE: Assigned to Committee on General and Production of Gas, also Committee on Distribution of Gas.

Part 8. BOTTLED GAS SYSTEM: Assigned to Committee on General and Production of Gas.

Part 9. BLAST FURNACE, PRODUCER AND GASOLINE GAS: Assigned to Committee on General and Production of Gas, also Committee on Distribution of Gas.

Part 10. UTILIZATION — INFORMATION FOR USERS: Assigned to Committee on General and Production of Gas, Committee on Distribution of Gas, Consuming Appliances and Committee on Gas Fitting and Appliance Installation."

The personnel of the Committee appointed on February 17, 1916, is as follows:

PERSONNEL OF AMERICAN GAS INSTITUTE COMMITTEE ON NATIONAL GAS SAFETY CODE

W. R. Addicks, Chairman.
H. B. McLean, Secretary.

GENERAL AND PRODUCTION OF GAS

Eastern:

Wm. H. Gartley, Philadelphia, Pa., Chairman.

G. Beadenkopf, Baltimore, Md.
R. W. Bush, Brooklyn, N. Y.
F. N. Dow, Portland, Me.
C. H. Graf, Albany, N. Y.
T. F. Holden, Washington, D. C.
A. C. Humphreys, New York, N. Y.
W. P. Knowles, Richmond, Va.
W. C. Morris, New York, N. Y.
C. H. Nettleton, Derby, Conn.
H. Russell, Rochester, N. Y.
R. E. Slade, Providence, R. I.
H. von Vittinghoff, Boston, Mass.
H. D. Whitcomb, Newark, N. J.
G. E. Woods, New York, N. Y.

Central:

E. G. Cowdery, Chicago, Ill., Chairman.

R. B. Brown, Milwaukee, Wis.
V. F. Dewey, Detroit, Mich.
G. B. Evans, St. Louis, Mo.
H. M. Harriman, New Orleans, La.
S. E. Linton, Jr., Nashville, Tenn.
Geo. McLean, Dubuque, Iowa.
F. C. Shepard, Minneapolis, Minn.
R. H. Smith, Jackson, Miss.
W. H. Taylor, Omaha, Neb.
W. H. Wright, Indianapolis, Ind.

Western:

E. C. Jones, San Francisco, Cal., Chairman.

A. B. Day, Los Angeles, Cal.
E. L. Hall, Portland, Ore.
F. K. Lane, Seattle, Wash.
A. F. Traver, Denver, Colo.
W. B. Tuttle, San Antonio, Tex.

DISTRIBUTION OF GAS

Eastern:

Walton Forstall, Philadelphia, Pa., Chairman.

W. G. Africa, Manchester, N. H.
G. E. Allyn, Providence, R. I.
G. R. Althen, Baltimore, Md.
T. R. Beal, Poughkeepsie, N. Y.
J. A. Clark, Jr., Newark, N. J.
R. C. Congdon, Atlanta, Ga.
Harry Ellis, Camden, N. J.
A. F. Ganz, Hoboken, N. J.
J. A. Gould, Boston, Mass.
J. S. McIlhenny, Washington, D. C.
R. J. Marks, Norfolk, Va.
A. S. Miller, New York, N. Y.
C. C. Simpson, New York, N. Y.
J. T. White, Brooklyn, N. Y.
C. F. Zeek, Pensacola, Fla.

Central:

J. D. von Maur, St. Louis, Mo., Chairman.

C. W. Bradley, Chicago, Ill.
C. N. Chubb, South Bend, Ind.
F. L. Cross, Madison, Wis.
S. E. De Frese, Chattanooga, Tenn.
J. Hellen, Grand Rapids, Mich.
J. B. Hirst, Chicago, Ill.
R. A. Jayne, Detroit, Mich.
F. W. Sargent, Indianapolis, Ind.

Western:

A. B. Macbeth, Los Angeles, Cal., Chairman.

F. R. Rain, Los Angeles, Cal.
D. E. Keppelmann, San Francisco, Cal.
C. W. Koiner, Pasadena, Cal.
W. A. Leuenberger, Tacoma, Wash.
H. C. Morris, Dallas, Tex.

DESIGN AND CONSTRUCTION OF GAS CONSUMING APPLIANCES

Eastern:

O. H. Fogg, New York, N. Y., Chairman.

T. M. Ambler, Brooklyn, N. Y.
G. S. Barrows, Providence, R. I.
C. O. Bond, Philadelphia, Pa.
A. P. Brill, Pittsburgh, Pa.
Theo. Bunker, Newark, N. J.
W. M. Crane, New York, N. Y.
L. R. Dutton, Syncote, Pa.
T. J. Little, Jr., Gloucester, N. J.
J. P. MacSweeney, Rochester, N. Y.
G. T. Macbeth, Mt. Vernon, N. Y.
Sydney Mason, Gloucester, N. J.
H. K. Morrison, Lynn, Mass.
E. B. Myers, Philadelphia, Pa.
J. A. Norcross, New Haven, Conn.
P. F. Reichhelm, New York, N. Y
C. V. Roberts, Philadelphia, Pa.
R. S. Scott, Baltimore, Md.
G. W. Thomson, Chester, Pa.
S. T. Willson, Brooklyn, N. Y.

Central:

G. R. Chamberlain, Grand Rapids, Mich., Chairman.

J. J. Burns, St. Louis, Mo.
G. W. Clabaugh, Omaha, Neb.
R. K. Clark, Chicago, Ill.
H. M. Eaton, Detroit, Mich.
H. C. Fritz, Cleveland, Ohio.
R. B. Harper, Chicago, Ill.
D. McDonald, Louisville, Ky.
G. W. McKee, Rockford, Ill.
H. D. Schall, Detroit, Mich.
G. Steinwedell, St. Paul, Minn.

Western:

C. N. Stannard, Denver, Colo., Chairman.

C. B. Babcock, San Francisco, Cal.
V. E. Britton, San Francisco, Cal.
J. C. D. Clark, Salt Lake City, Utah.
F. A. Cressey, Jr., Modesto, Cal.
H. H. Jones, San Diego, Cal.
G. Wehrle, Denver, Colo.

GAS FITTING AND APPLIANCE INSTALLATION

Eastern:

Wm. A. Wood, Boston, Mass., Chairman.

J. H. Braine, Brooklyn, N. Y.
W. A. Castor, Philadelphia, Pa.
C. M. Cohn, Baltimore, Md.
C. H. Dickey, New York, N Y.
J. B. Douglas, Philadelphia, Pa.
A. E. Forstall, New York, N. Y.
W. G. Gribbell, Philadelphia, Pa.
A. H. Hall, New York, N. Y.
W. K. Harrington, New York, N. Y.
Frank Hellen, Rochester, N. Y.
W. D. Kelley, New York, N. Y.
R. M. Kellogg, Mt. Vernon, N. Y.
C. A. Learned, Meriden, Conn.
H. A. Norton, Boston, Mass.
Chas. Otten, Jr., Haverhill, Mass.
C. E. Paige, Malden, Mass.
F. A. Schobel, Albany, N. Y.
H. H. Sprague, Bridgeport, Conn.
P. S. Young, Newark, N. J.

Central:

Paul Doty, St. Paul, Minn., Chairman.

Horace H. Clark, Chicago, Ill.
J. W. Dunbar, New Albany, Ind.
LaRue B. Elliott, Chicago, Ill.
A. Hurlburt, Kansas City, Mo.
T. C. Jones, Delaware, Ohio.
Joseph Lucena, Omaha, Neb.
Carroll Miller, Aurora, Ill.
J. M. Morehead, Chicago, Ill.
A. A. Treadway, Detroit, Mich.
G. I. Vincent, Des Moines, Iowa.

Western:

H. M. Papst, Portland, Ore., Chairman.

J. M. Berkley, Los Angeles, Cal.
W. J. Dorr, Los Angeles, Cal.
E. S. Jones, Sacramento, Cal.
J. D. Kuster, San Jose, Cal.
F. A. Leach, Jr., Oakland, Cal.
K. L. Simons, El Paso, Tex.
H. L. Strange, Honolulu, Hawaii.

It should be noted here as of October 7, 1916, that in addition to the committees the Institute is represented by Messrs. W. J. Serrill and J. B. Klumpp as members of the Board of Advisory Engineers to the Bureau of Standards which is composed of the following representatives of the associations named:

American Gas Institute, W. J. Serrill and J. B. Klumpp.

National Commercial Gas Association, O. H. Fogg and W. W. Barnes.

Natural Gas Association, S. S. Wyer.

National Fire Protection Association, C. A. Hexamer and F. J. T. Stewart.

American Institute of Architects, D. E. Waid and Julius Franke.

National Safety Council, H. W. Forster and J. M. Morehead.

Public Health Service, Dr. J. W. Schereschewsky.

National Association of Master Plumbers, T. P. McLoughlin.

Bureau of Mines. No representative yet named.

A meeting of the entire committee was held in Chicago on Wednesday evening, October 18, 1916.

During 1916, pressure of departmental matters compelled the Bureau of Standards to lay aside active work on the code and the intervention of the war period compelled the members of the committee to turn their attention to other matters.

On June 6, 1918, the American Gas Institute and the National Commercial Gas Association were merged to form the "American Gas Association."

The formation of the American Gas Association and the intervention of the world war caused all further consideration of this code to cease and a great deal of good work was wasted as nothing came of this code.

American Gas Association

On April 28, 1920, the Executive Board of the American Gas Association accepted an invitation from the American Engineering Standards Committee to act jointly with the Bureau of Standards as sponsors for the Gas Safety Code.

May 1, 1920, the Executive Committee of the American Gas Association requested Mr. Addicks to act as Chairman of the Gas Code Committee and in August of that year the American Engineering Standards Committee asked to be advised of the personnel of the American Gas Association Gas Code Committee when it was formed. The Bureau of Standards in September suggested the American Gas Association appoint sixteen members on the sectional committee, these sixteen members representing the gas companies and the manufacturers of gas appliances, the Bureau of Standards to invite in the name of the American Gas Association and the Bureau of Standards sixteen additional members from among the interests concerned and in line with this suggestion Col. Fogg, on September 21, 1920, submitted to the Bureau of Standards the names of the proposed members of the American Gas Association Sectional Committee. September 23-27, 1920, Mr. Addicks wrote the proposed members asking them if they would accept appointment and acceptances were duly received from all as follows:

G. I. Vincent, Engineer, Syracuse Lighting Company, Syracuse, N. Y.

J. D. Von Maur, Sup't Distribution, Laclede Gas Light Co., St. Louis, Mo.

A. B. Macbeth, Vice-Pres. & Gen'l Mgr., Southern California Gas Co., Los Angeles, Cal.

W. J. Serrill, Engineer of Distribution, The United Gas Improvement Co., Philadelphia, Pa.

R. B. Brown, Vice-President, Milwaukee Gas Light Co., Milwaukee, Wis.

*D. D. Barnum, Vice-President, Boston Consolidated Gas Co., Boston, Mass.

R. B. Harper, Chief Chemist, Peoples Gas Light & Coke Co., Chicago, Ill.

R. G. Griswold, Chief Technologist, Henry L. Doherty & Co., New York, N. Y.

R. S. Doull, Consolidated Gas Co., New York, N. Y.

E. H. Earnshaw, Ass't General Manager, Public Service Gas Company, Newark, N. J.

A. H. Hall, Ass't Treas. & Sup't Distribution, Central Union Gas Company, New York, N. Y.

H. M. Papst, General Manager, Portland Gas & Coke Company, Portland, Ore.

Geo. H. Wehrle, Denver Gas & Electric Light Co., Denver, Colo.

R. C. Congdon, Sec'y and Manager, Atlanta Gas Light Co., Atlanta, Ga.

W. G. Gribbel, John J. Griffin Company, Philadelphia, Pa.

Geo. S. Barrows, Mgr. Gas Heating Department, The Grinnell Company, Providence, R. I.

W. R. Addicks, Vice-President, Consolidated Gas Company, New York, N. Y.

Tentative draft of the various parts of the code were received from the Bureau of Standards as follows:

Part I, Manufacture, Sept. 25, 1920.
Part II, Distribution, June 2, 1920.
Part III, Gas Fitting, June 2, 1920.
Part IV, Appliance Design, Feb. 15, 1921.
Part V, Appliance Installation, Feb. 15, 1921.

On December 17, 1920, a sufficient number of mimeograph copies of Parts I, II and III of the tentative draft were sent to the various members of the American Gas Association committee for their criticism and suggestions for amendment, with a request that they confer with representative gas men in their several localities for the benefit of their viewpoint, and on April 4, 1921, mimeograph copies of Parts IV and V were forwarded to the members of the American Gas Association committee for the same purpose.

When the criticisms and suggestions for amendment had been received from every member of the committee for all the various sections of the five parts of the code they were compiled according to sections and on September 30, 1921, Mr. Addicks wrote the members of the committee suggesting a meeting of the committee as a whole on the occasion of the Annual Meeting of the American Gas Association in Chicago, November 7th and 8th, 1921: The replies, however, indicated the impracticability of having a meeting at that time.

On October 31, 1921, Mr. Addicks made a report to the Executive Board of the American Gas Association of the progress being made on the code and was informally advised that the Executive Board took the attitude that the Gas Safety Code contemplated certain fields not reasonably within the proper scope of such a document and that it was the opinion of the board that the Gas Safety Code should not deal with this matter insofar as it relates to our works structures, processes of manufacture or distribution system and that it should be confined to the distribution of gas within the building of the consumer.

Realizing the difficulty of having a meeting of the entire committee because of the distances they were apart, Mr. Addicks on October 31, 1921, wrote to the members of the committee that he proposed to form a small revision committee to consider the code in its entirety and the criticisms submitted by all the members, and at the same time forwarded a copy of the compilation of

*Subsequenty (Dec. 7, 1921) at the request of Mr. Dana D. Barnum, then President of the American Gas Assocation, Dr. J. F. Wing was substituted for Mr. Barnum on this Committee.

criticisms on Parts I, II and III (each forming a separate pamphlet) for their information together with request to be furnished with criticism on Part V, "Appliance Installation"; Mr. Addicks also expressed the opinion that the major part of the work should be devoted to Parts III and V.

November 4, 1921, Mr. Addicks invited six members of the American Gas Association Sectional Gas Code Committee to become members with him, as Chairman, of a sub-committee to consider the code as he had stated in his letter of October 31, 1921. This subcommittee consisted of:

Mr. E. H. Earnshaw, Public Service Gas Co., Newark, N. J.
Mr. R. G. Griswold, c/o H. L. Doherty & Co., 60 Wall St., N. Y.
Mr. R. S. Doull, Consolidated Gas Co., 130 E. 15th St., N. Y.
Mr. A. H. Hall, Central Union Gas Co., 529 Courtlandt Ave., N. Y.
Mr. W. J. Serrill, United Gas Imp. Co., 1401 Arch St., Philadelphia, Pa.
Mr. Geo. S. Barrows, c/o Grinnell Co., Providence, R. I.
Mr. W. R. Addicks, (Chairman) 130 E. 15th Street, N. Y.

On June 6, 1922, Mr. Addicks forwarded to the members of the sub-committee appointed November 4, 1921, tentative drafts of Section No. III, "Gas Fitting," and Section No. V, "Appliance Installation," consisting of the original drafts received from the Bureau of Standards with the criticisms received from members of the American Gas Association Sectional Committee incorporated therein. Mr. Addicks expressed the opinion that the code, even though it consists of only Sections III and V, was too lengthy and that it would be well if the code had a few salient rules and the remainder of the proposed code printed as an addendum for discussion rather than as of obligatory nature, and requested suggestions as to date of meeting of sub-committee.

A meeting of the sub-committee was held in New York City on June 22-23, 1922. (Mr. T. S. Holden, representing Mr. Chas. B. Scott, Chairman of A. G. A. Committee on Prevention of Accidents, present by invitation) at which all matters pertaining to the code were thoroughly discussed and it was finally decided to have the code prepared in one volume placing all rules with amendments agreed upon under appropriate headings. At this meeting Mr. Serrill submitted a tentative suggestion for a code entitled "Part I—Rules."

On July 1, 1922, Mr. Addicks wrote to Dr. Stratton, Director of the Bureau of Standards, that the sub-committee of the American Gas Association Sectional Gas Code Committee believed that the Bureau of Standards should be represented at the meetings of the sub-committee and invited him to designate a representative to attend the next meeting of the sub-committee at a date to be selected later. Dr. Stratton wrote that it gave him pleasure to accept this invitation.

On October 11, 1922, Mr. Serrill, member of the sub-committee, submitted a tentative code to Mr. Addicks drawn up to meet the views expressed by the committee at the meeting held June 22-23, that the code should consist of a few salient rules with an addendum discursive rather than obligatory in character. On November 28, 1922, a copy of the proposed code prepared by Mr. Serrill was sent to each member of the sub-committee, and on November 29, 1922, a copy of the code (Parts III and V) in one volume, prepared in accordance with the rule adopted at the meeting of June 22-23, 1922, was sent to each member of the sub-committee and to Dr. Stratton.

On December 13, 1922, the sub-committee met in New York City, Mr. Walter M. Berry and Dr. M. G. Lloyd, representing the Bureau of Standards, were present. After a general discussion of the proposed code, its arrangement to comply with the American Engineering Standard Committee's "Suggestion on form and arrangement on Safety Code," and the proposed arrangement of the code submitted by Mr. Serrill, Mr. Addicks appointed a special committe econsisting of three members to consider the whole subject and submit their recommendations at a later date: Mr. Addicks suggested that this special committee consult with Mr. Barrows with respect to matters relating to the manufacturing interests and also with the Bureau of Standards.

That there may be no confusion in the reader's mind because of the sending out to the members of the sub-committee the copy of Mr. Serrill's code on November 28, and the copy of the code (Parts III and V) in one volume on November 29, it might be well to say that Mr. Serrill's code is founded upon the data secured in the consideration of Parts III, IV and V, and includes in the addendum the major portion of the data compiled in one volume of Parts III and V of the originally drafted code.

At the meeting of the special committee on May 11, 1923, at which Mr. Berry, representing the Bureau of Standards, was present, the code submitted by Mr. Serrill was adopted as to form, subject to possible revisions and rearrangement of details, as the proper basis for final consideration by the Sectional Gas Code Committee of the American Gas Association.

Under date of July 20, 1923, Director Burgess of the Bureau of Standards wrote Mr. Addicks requesting that the meeting of the Sectional Committee be held at Washington on September 5, and made a number of suggestions and comments as to matters pertinent for consideration at the proposed meeting. The chairman sent copies of Dr. Burgess' letter to all the members of the American Gas Association's Sectional Committee requesting comment and when replies had been received wrote Dr. Burgess under date of August 7 that the consensus of opinion of the members of the committee was that Dr. Burgess' invitation should be accepted, but that it might be well to have the meeting at some date later than September 5, because of local conditions affecting the companies of the members of the committee, suggesting some date during the week before the Annual Meeting of the American Gas Association, October 15th to 19th inclusive. Mr. Addicks also submitted the names of some gentlemen identified with gas appliance manufacture whom it might be desirable to have present at the Washington conference.

In preparation for the Washington conference the code prepared by Mr. Serrill, with the latest revisions made thereto, was ordered printed for use by all the sponsors of the code.

The foregoing is intended to give a general historical and chronological account of the various activities and steps taken in the preparation of the code from the formation of the first committee to undertake the work up to the present time. It is hoped the preparation of the code will reflect the best and safest practice.

(Motion duly made, seconded, and carried that the report on the status of the National Gas Safety Code be accepted and printed in the Proceedings.)

REPORT OF COMMITTEE ON RATE STRUCTURE

T. V. Purcell, *Chairman,* Chicago, Ill.

Rate structure is not a new study. Forty years ago Mr. Norton H. Humphreys, in a communication to the Journal of Gas Lighting, referred to the necessity of analyzing costs for the purpose of rate-making. A review of the literature of the subject discloses the fact that the question of correct pricing has been discussed year after year before the national associations of both gas and electrical industries.

Without attempting to indicate the most important contributions to the subject, it is proper to pay tribute here to the famous papers of Dr. John Hopkinson, W. J. Green, Arthur Wright, and Henry L. Doherty—all of them written over twenty years ago.

These great pioneers have left very little to be said on the fundamentals of rate making. The principles were enunciated so clearly and established so firmly that there never has been any considerable difference of opinion. The subject was dealt with not only in a technical way but attention was called in no uncertain terms to the inequity of rates that disregarded load-factor and to the very unfavorable influence of such rates on the development of the business. Notwithstanding this the astonishing fact remains that little or no real progress has been made in the gas industry in this most important matter.

Our friends in the electric industry were not so short-sighted. Rates for electricity almost from the beginning have been constructed on the basis of analyzed costs thus making possible competition with other forms of energy and resulting in the taking on of many loads of great diversity that would not have been obtainable with rates that failed to consider "load factor."

More by good fortune than by good management we have been able to replace our proportionately diminishing lighting load with gas for cooking, but the cooking load can not be depended on indefinitely to continue the prosperity of the industry. There are several conditions arising especially in larger cities, that threaten this very important fraction of our sales.

It is of vital importance that progress be made in the development of uses for gas other than for lighting and cooking. This is equivalent to saying that, if scientific rates were desirable twenty-five years ago, they are imperative now. Unless we offer the customer who makes long hour use of his demand a rate much closer to the actual cost of serving him we can not begin to compete with other fuels. This means that we will continue to shut ourselves out of the "industrial" field with its almost limitless possibilities.

It is the belief of your committee that the future of the industry presents a problem for the most serious consideration. There is no general per customer

increase in the cooking load. The situation would be serious indeed if it were not for the fact that uses for gas loom up that stagger the imagination. But this prospective business is quite out of reach with poorly designed rates that do not reflect true costs. Your committee, therefore, recommends that members give this matter earnest consideration and take such measures as may be practical to bring to the attention of public utility commissions the advantage to customers and companies alike of providing rates that would enable us to compete for large consumption business. The great increase in the volume of gas required to be produced and the improvement in plant load factor following the connecting up of such business would inevitably result in lower costs in which even the small customer who is now carried at a loss would eventually share.

When costs are properly allocated it will be found that from 60 to 75 per cent of the customers are carried at a loss under existing rates. This is because systems of rates are so largely on a commodity basis whereas analysis discloses that costs having no relation to the amount of commodity used will amount to from $1.25 to $2.50 per month for average customers using 5 light meters.

What is needed in this connection is; *first,* a study of costs as divided into the three parts, "customer," "demand," and "commodity" (giving consideration to sub-divisions of demand) and *second,* a classification or tabulation of customers according to amount of monthly consumption, and in connection with such tabulation, a study of the kind of customers that make up the various classes. Such a study will show who are the small customers and who are not. It will appear that the laboring man is not the small customer, as a rule, but that his consumption is very near the average of all domestic customers.

While the committee urges a study of the fundamentals of rate structure to the end that our rates may be made equitable and competitive, it also realizes that some departure from the results of strict cost analysis must and will be made for reasons of practicability.

Gas for househeating is one of the big opportunities. A rate structure is urgently needed that will make househeating by gas possible and hasten its development. But it must be done at a profit. The rates must, therefore, be based on accurately determined costs of this specific service. Since new production capacity will have to be provided on the basis of the *daily* demand of househeating, the *annual* load factor of this business must be given careful consideration. The effect of househeating on distribution capacity is, of course, a function of *hourly* demand.

A thorough study of the present load should be made with particular reference to both *hourly* and *daily* "demand" and to both *hourly* and *seasonal* "diversity." A similar study should be made of the prospective househeating load and the results compared.

A brief investigation shows that the best annual load factor of manufactured gas plants having little househeating business is something like 300 days use of the maximum *daily* demand on manufacturing plant, or *82 per cent* load factor of production, and 2,600 hours use on the maximum *hourly* demand on distribution plant, or *29 per cent* load factor of distribution.

Househeating (used over a period of 7 months—in climates of long winters) has the following characteristics:

90 days use of the maximum *daily* demand on manufacturing plant, or *25 per cent* load factor of production, and
2000 hours use of the maximum *hourly* demand on distribution plant, or *23 per cent* load factor of distribution.

Referring to the annual load factor of manufacturing plant with present business, we find that this is due not to the excellence of the load factor of the individual customers, but to the great diversity among customers as to their *hourly, daily,* and *seasonal* use. It is this diversity which reduces the sum of their individual demands to proportionately a very low figure of actual demand made upon the plant.

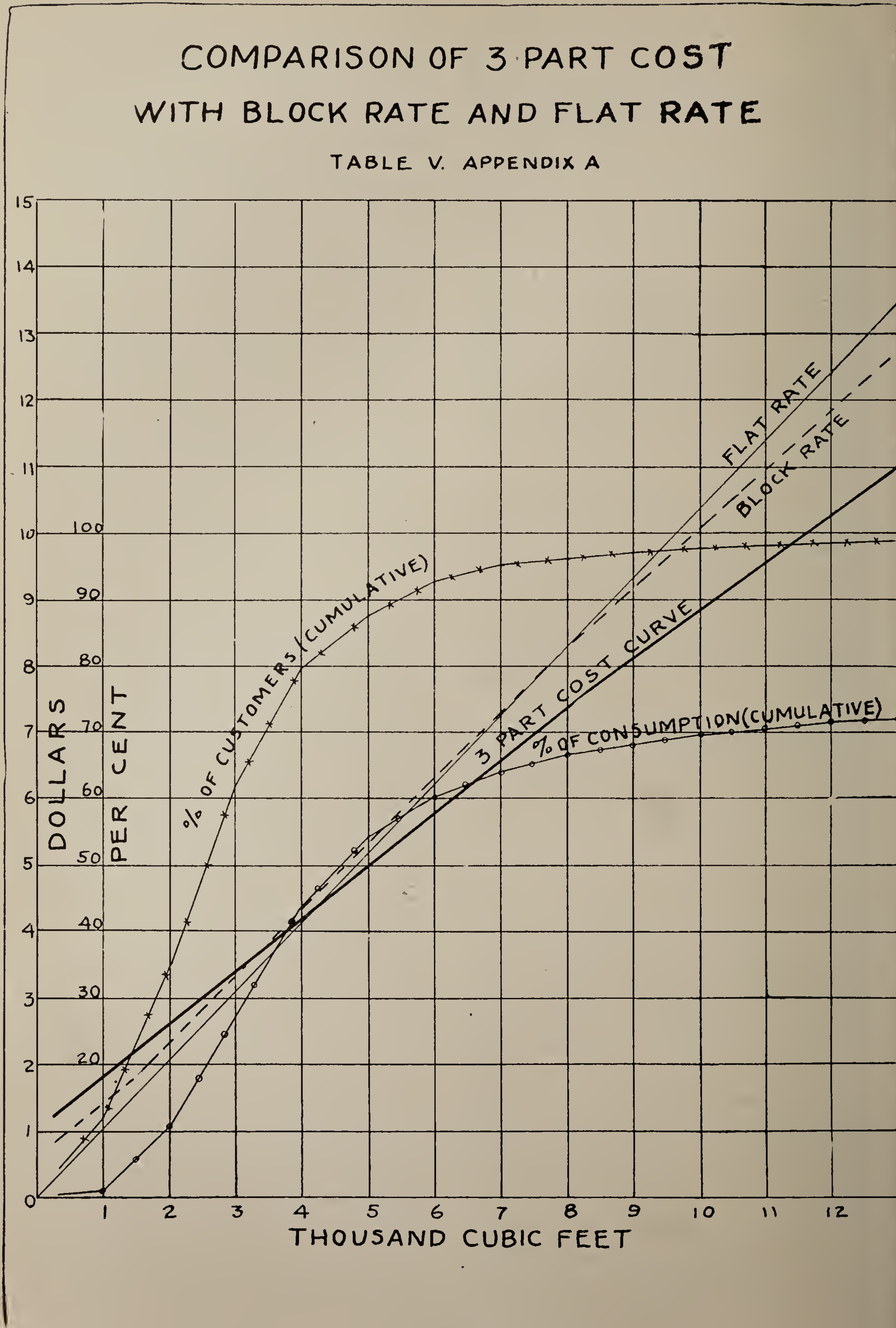
The committee has discussed at great length theories of allocation and has taken advantage of the very important work of preceding committees. The result of this discussion has been embodied in a paper by Mr. Ewald Haase as Appendix A to this report. Mr. G. I. Vincent contributes a short discussion on the allocation of costs (Appendix B) and Mr. F. L. Daily contributes a memorandum of the views of Public Utility Commissions as expressed in various orders and decisions (Appendix C).

A very practical review of the rate situation can be made by a careful perusal of Rate List No. 1 giving the rates in effect December 31, 1922, in 964 localities reporting to the American Gas Association. A tabulation of these rates is attached to this report as Appendix D.

Mr. F. C. Hamilton has prepared an outline of the information which should be presented to a regulating body with an application for a change either as to amount or form of rates. This is Appendix E.

The Committee has made extensive use of the Bibliography on Rates prepared by Mr. O. E. Norman. This bibliography covers articles and papers on the subject from the year 1876 to July 1, 1923, inclusive. It is very complete and should be of great value to students of this subject. The Committee, therefore, includes it in its report as Appendix F. but constituting a separate pamphlet.

The Paper on Cost of Service, etc., (Appendix A) by Ewald Haase, Milwaukee, Wisconsin, is a revision of a paper by the same author, published as Appendix A in the 1922 Rate Structure Committee Report. This revision contains an extensive discussion of the nature of cost factors, especially of demand and of diversity among customers' demands; it sets up definitions of terms used in the paper; it makes an allocation of costs based upon the "Uniform Classification of Accounts" as applied to an actual set of accounts for the year 1922. In this analysis a refinement was introduced in allocating costs of production and distribution by separating the demand items into two amounts, one production demand, the other distribution demand, to which are applied different units of measurement; for production the twenty-four hour demand and for distribution the hourly demand. The two items taken together then form the demand element of cost. This treatment in no wise weakens but rather emphasizes the demand element in the three-part cost structure. After thus finding the costs as they exist in this case, and having reduced them to costs per unit of customer, demand, and commodity, the costs so found are applied in an extensive computation (Table IV) to the customers grouped in classes of monthly consumption and finally the cost per customer in each group is arrived at. This computation proceeds on the assumption that customers' demands may be averaged for



COMPARISON OF 3 PART COST
WITH BLOCK RATE AND FLAT RATE
TABLE V. APPENDIX A
DOLLARS
PER CENT
THOUSAND CUBIC FEET
FLAT RATE
BLOCK RATE
3 PART COST CURVE
% OF CUSTOMERS (CUMULATIVE)
% OF CONSUMPTION (CUMULATIVE)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
20 30 40 50 60 70 80 90 100

each such group, for only on this assumption would such a computation be possible. The assumption that customers' demands may be averaged for consumers grouped according to amount of monthly consumption is permissible only as applied to present uses having the demand characteristics and load factors of the combined cooking, water heating, and lighting load, because the computation is based upon demands as they now exist.

Following this is a discussion and illustration of the construction of a block rate, Appendix A, Table V.

Referring to Appendix A, Table V, the graphic illustration opposite shows that cost of service is above the revenue line up to 3,300 cu. ft. if that particular block rate is assumed, or up to 4,500 cubic feet if a flat rate is assumed. Sixty-eight per cent of customers are under the cost curve in the case of the block rate, and eighty-four per cent in the case of the flat rate. The deficiency of revenue from each of the *large percentage of customers* whose revenue is less than the cost, becomes a substantial burden when carried by the *few* remaining customers who make it up by large additions to an already large bill in the case of the flat rate. The block rate here assumed tends in the direction of placing the costs where they belong. In the first place it cuts down the loss from small consumers and spreads the remaining loss over a larger number of customers rather than to let it fall upon few customers in very large amounts, as does the flat rate. Reference to Table IV, Analysis of Gas Bills, shows that a large percentage of customers are nue lines, which suggests the possibility
nue lines, which suggest the possibility and advisability of selling this large class of customers additional gas, as for water heating, which will bring them out of the class wherein they almost pay the average return, to where they will pay it entirely.

Finally there is a discussion and illustration of the application of a three-part rate for large consumers.

Mr. Vinçent of Syracuse, New York, submits an allocation of costs (Appendix B) to show in the simplest possible way the inequity of the flat rate. In this statement the technical details have been reduced to a minimum. It will be found very interesting and useful by those who desire by education to encourage the public and authorities toward the acceptance of better rate structures.

Mr. Daily's memorandum of court and commission decisions (Appendix C) illustrates the progress over the country as a whole in the matter of gas rate structure. So far as the matter permits of such generalization, it may be gathered from the cases cited that the commissions first broke away from flat rates by permitting the introduction of a minimum bill: that as wartime costs gave rise to a need for further revenue, they began to substitute for the minimum bill a service charge, usually equal for all consumers; that in some instances, this was modified by the introduction of a service charge the amount of which was graduated in accordance with the individual consumer's probable demand, variously determined. No attempt is made to cover the numerous cases in which the commissions have allowed block or step rates on the theory that they sufficiently reflect the differences in cost, the memorandum being concerned rather with those cases wherein the companies have been permitted to make a frank separation between their commodity charges and the charges covering their other costs. A few water rate cases have been

included, the governing considerations being similar.

The Committee wishes to acknowledge the great value of the counsel and contributions to its work from others than members, and its appreciation is hereby expressed to: Hon. Carl D. Jackson, W. F. Douthirt, T. C. O'Hare, F. L. Daily, G. E. McKana, F. J. Strickler, R. G. Griswold, W. J. Hagenah and O. E. Norman.

APPENDIX A

COST OF SERVICE AND RATES BASED ON SAME

Ewald Haase, Milwaukee, Wis.

SYNOPSIS

Cost of Service is the most important element in rate structure. Costs are of three classes: those proportionate to "customers," to "demand," and to "commodity." These are discussed, defined, and a set of costs are allocated. After finding unit costs for "customer," "demand" and "commodity" charges they are (in Table IV) applied to customers, grouped in imaginary classes, within steps of monthly consumption. Such classification presumes as fact, that steps of monthly consumption represent groups in which the uses for gas are for similar purposes therefore have similar load factors, and that there is diversity of demand within the groups. Costs per unit in each such group or class being found, they may be compared with revenue per unit produced under any given rate (Table V). Uses requiring large volumes of gas, used under greatly varying demands, and on account of having widely differing load factors, should be sold under rate schedules based on three part cost factors. Demands of such large users, and annual load factors based on 24-hour demand as well as momentary demand are basic studies.

COST OF SERVICE

There are probably a number of elements that should be taken into consideration in making rates for gas service, but of these the "cost of service" is easily the most important. Another element in rate making, and it has been called one of the controlling elements, is the value of service. Public policy also enters as an element as a matter of expediency if not on economic grounds.

It is quite essential in an analysis of the cost of service that the same proceed along correct principles, in order that the results may reflect correctly the effect of the several factors which create the costs.

If customers individually can come in and ask that certain property shall be devoted to their exclusive use; that extensions be made for them as individuals; that certain expenses be incurred for service to them, then such expenses should be averaged among customers and such averaged costs assessed against each customer. These costs obviously are not proportionate to the quantity of gas customers will use.

The *use* of gas by customers brings about several factors of cost that must be examined. Such factors are not all proportionate to the *quantity* of gas used during a period of time, as a month or year. They are proportionate, rather, to the quantity *demanded* over a short period, as an hour and a day. Two customers may use at the moment of heaviest demand on the distribution system, the same quantity of gas, the one using it for an hour a day, while the other may use that same quantity for ten hours. These two customers require each for their demands, distribution capacity of the same size (and value) but the first

customer will require only one-tenth of the *manufacturing capacity* that the other requires. This illustration is an arbitrary one but in actual experience there are many customers who make the same demand on distribution of plant, yet make very different demands on the manufacturing plant or source of supply. Two customers *using the same quantity of gas per annum* may make practically *identical demands* at the hourly peak, but the one will have a 24-hour demand four or five times as great as the other.

These circumstances introduce the demand element into the cost analysis, and we find that the *demand factors* are of *two kinds,* namely, the *demand on manufacturing plant* and the *demand on distribution plant.*

Because gas can be, and is, stored in holders, and because the manufacturing process therefore is carried on throughout the twenty-four hours, and a works is rated on its twenty-four hour make, the demand on manufacturing capacity made by a customer will be that capacity which he requires to produce his maximum twenty-four hour use, *subject to diversity factor.*

Because distribution capacity must be equal to meet momentary or instantaneous demand of customers, the distribution demand factor of a customer will be that capacity which is required to deliver his momentary maximum demand subject to the *diversity* of use among customers.

Diversity of demand is a factor very difficult of determination, and yet its existence in the case of certain uses of gas, as well as its absence in certain other uses, is now recognized and diversity of demand cannot be ignored. One cannot think about the maximum demand on the distribution system made by a customer, without at once realizing that this demand will not coincide in point of time with the maximum demand of every other customer. Indeed we have no difficulty in recognizing the existence of wide diversity as to the hour or as to the day of the occurrence of maximum momentary demands of customers. Likewise we cannot contemplate the maximum 24-hour demand a customer makes without thinking of the diversity of coincidence of his demand with that of others. They may occur on different days and at different seasons.

There is diversity of use among customers, first, as to the moment or hour in which their demand is made; then as to the particular twenty-four hour period in which the demand is made, and also as to the season in which the demand is made. It will be seen at once that these factors must be correctly determined if the effect of these conditions of the use of gas shall be correctly reflected in the cost factors.

There remain the costs that are proportionate to the quantity or volume of commodity.

In the preceding discussion we have referred to all the costs entering into the service of gas supply, and placed them into four classes, each of which is rated on a different basis, being determined by different controlling factors, namely:

Customer Costs
Manufacturing Demand Costs
Distribution Demand Costs
Commodity Costs

Having made an allocation of costs as they are determined by the four factors of (1) customers; (2) demand on manufacturing capacity; (3) demand on distribution capacity; (4) commodity used, the four totals may be reduced to unit

costs by using the divisors (1) number of customers; (2) maximum twenty-four hour demand; (3) maximum momentary demand; (4) total commodity used.

It will not do to rate the manufacturing capacity by the momentary demand, for a gas works, unlike an electric generating station, operates to meet by (as nearly as possible) a uniform rate of production, the total demand of a twenty-four hour period, or a period of say three days, equalized by fluctuating holder storage.

TERMS DEFINED

Certain terms used in this discussion and in the following cost analysis are defined as follows:

1. *Manufacturing Demand*: Manufacturing Demand is the maximum production which the manufacturing plant is called upon to deliver in a twenty-four hour period. It is so measured because the plant generates at more or less uniform rate throughout twenty-four hours.

2. *Distribution Demand*: Distribution Demand is the maximum actual momentary delivery. It is usually measured by the maximum ten or fifteen minute output and stated in terms of cubic feet delivered during one hour at such ten or fifteen minute rate.

3. *Customer's Demand*: Customer's Manufacturing Demand is his maximum use during twenty-four hours, and his Distribution Demand is the maximum use for ten or fifteen minutes stated in terms of cubic feet per hour at such ten or fifteen minute rate, both subject to diversity.

4. *Load Factor of Plant*: Load factor of plant is the ratio of the actual maximum output to plant capacity used full time.

Thus, a manufacturing plant having a maximum daily capacity of 20,000,000 cu. ft. and with annual sales of 6,000,000,000 would have an annual load factor of

$$\frac{6{,}000 \text{ million}}{20 \text{ million} \times 365} = 82\%$$

A distribution plant of 2,500,000 maximum hourly output and with annual sales of 6,000,000,000 would have an annual load factor of

$$\frac{6{,}000 \text{ million}}{2.5 \text{ million} \times 8760} = 27\%$$

5. *Load Factor of Customer*: Load factor of Customer is the ratio of the actual quantity of gas used to his demand used full time.

A customer having a twenty-four hour demand of 5,000 cu. ft. and annual consumption of 500,000 cu. ft. has an annual load factor of manufacturing capacity demanded of

$$\frac{500{,}000}{5000 \times 365} = 27\%$$

His distribution annual load factor on an hourly demand of 250 ft. would be

$$\frac{500{,}000}{250 \times 8760} = 23\%$$

6. *Diversity Factor*: Diversity factor is the ratio of the sum of customers *maximum* demands to total actual demand at plant.

There is applicable to practically all observed customers' demands what is known as diversity factor. Not all customers use their maximum demand at the same time or in the same unit period. The sum of all the maximum demands of customers is greatly in excess of the actual demand on the plant. This arises out of the diversity of use on the part of the individual customers. The demand on manufacturing capacity in the twenty-four hour cycle is subject to less diversity, the total varying less between customers and classes of customers, than is the demand on distribution capacity. Diversity of demand on manufacturing capacity arises out of the following conditions:

Difference in demand of the individual customer as between one day and another. Seasonal diversity occurs through uses falling away at certain seasons of the year, while others take their place. Dis-

tribution demand is diversified because some demands do not come at peak hour at all but at an hour decidedly remote from the peak. Among domestic customers the use of the maximum demand does not fall at the same period of the day and on the same day of the week. How great this diversity is is realized at times when, because of the general custom, as on Thanksgiving Day, of cooking large dinners at the same hour, the heaviest peak of the year is brought about. Lack of these peaks on other days indicates that the demand of customers occurs at varying periods of the day. The diversity for customers as a whole is the summation of greatly varying diversity factors for individual customers, or groups of customers classified as to similarity of demand.

ANALYSIS OF COST OF SERVICE

The income that a utility is reasonably entitled to under the system of State regulation must be sufficient to cover the costs of producing its commodity and of selling and rendering its service, including the cost of maintenance of its property in first class operating condition, the taxes that it is obliged to pay upon its property and income, a fair amount to cover the ultimate retirement of that portion of the property which wears out or becomes obsolete, and besides a fair return upon the fair value of the property as a whole devoted to the public use.

A utility has invested, and devotes to the use of its customers, a great variety of property. Some of it is used exclusively in the production of its commodity; other portions are placed at the exclusive disposal of the individual customer and is subject to his will, to use or not, as he chooses. That portion of the property not devoted exclusively to the individual customer is nevertheless subject to his demand, and the capacity of the plant that the utility must provide is determined by the composite demand of all customers. Thus the manufacturing capacity must be equal to the combined demand of customers, sustained over such periods of time as their combined needs require.

The distribution system must be ample to carry, at sufficient pressure, the amount of gas that the combined demand of all customers may momentarily require. These two demand factors, that of manufacturing capacity and that of distribution capacity, govern the use and determine the costs of a large portion of the plant.

There are, however, considerable portions of the property devoted to the exclusive use of the customer, or their extent is determined or caused by the number of customers and the spread of location of such customers over territory, to which cost all customers contribute as customers, regardless of the quantity of commodity used. Such costs are known as "Customer Costs." Besides the Demand Costs and Customer Costs there remains the Commodity Cost.

ALLOCATION OF COSTS

In a utility furnishing a complex service, i. e. a service covering districts of radically different classes of service, (as for example a high pressure distribution in one and a low pressure in another), a street lighting system, the sale to outlying other utilities, etc., it will be necessary first to analyze property and expenses into these several functions before the allocation of costs in each function can proceed.

Such a case is not before us and such a functional analysis is therefore not illustrated.

In the following pages an allocation of costs is made and described which will embody the points discussed in the preceding pages, and which differs from the

methods employed in many another analysis, principally, in that the demand costs are classified under the two heads of manufacturing and distribution demand in accordance with the reasons given above.

The operating expenses, taken in the order of the "Uniform Classification of Accounts for Gas Utilities" are first analyzed and allocated.

Since, as has been shown, the property of the utility is partly placed at the service of customers, partly subject to their demands, an allocation of property has been made under headings denoting the use to which it is devoted, or the factors by which it is controlled, in order to furnish a basis upon which to prorate certain costs, such as retirement expense, taxes, and return on investment.

The following tests were applied, or characteristics noted, in determining the allocation of the several items of expense.

Customer Expense. To be classified under "Customer" an item must be of such a nature that it is controlled by the number of customers or that customers should equitably share alike in carrying the expense.

Demand Expense. To be classified under "Demand" an item must be of such a nature that it is controlled by, or incurred in proportion to, demand rather than governed by the quantity of commodity produced. If the item pertain to manufacturing plant it will go to Manufacturing Demand, and if pertaining to distribution to Distribution Demand.

Commodity Expense. To be classified under "Commodity" an item must be of such a nature that it ceases when output ceases, or increases as output increases.

Note: Certain items, for example the New Business and General and Miscellaneous Expenses, are clearly not directly related to any one of the four groups of cost. They are related rather to all four cost factors and should therefore be apportioned upon some basis, that seems reasonable, to all four.

ALLOCATION OF OPERATING EXPENSES

PRODUCTION

COAL GAS

701.1 Works Superintendence:

This is clearly a Demand item. It is fixed by the size and character of the plant, the whole of which is operated in conformity with demand.

701.2 Boiler Labor:

See Steam Account 712.

701.3 Retort Labor:

There will probably be a fixed portion of retort house labor that goes on regardless of whether output decreases or increases. Insofar as this labor item can be kept proportionate to output it should go into the Commodity column. The fixed or standby portion should go into the Demand column. The following note indicates one method of apportioning.

Note: Certain expenses are not altogether proportional to output as they do not cease with a decrease in output but remain more or less constant with the capacity of plant. A crew of plant operators can not be discharged when output must be cut down with reduced demands. The maintenance of apparatus goes on just the same though output is curtailed. Usually such items are nevertheless put entirely into output. The suggestion is here made that there be charged to output a percentage of the total expense equal to the load factor percentage and place the remainder into Demand.

Thus if a plant had an output for the period under analysis of 75 per cent of the full time capacity then 75% of such an expense would go into output and the remainder to Demand. This will not be entirely accurate in all cases and the allocation may have to be adjusted by other factors.

701.5 Purification Labor:
Entirely to Commodity.

701.6 Miscellaneous Works Labor:
This item probably varies partly in direct proportion to Output, and partly remains constant. A division of 50% to Demand and 50% to Commodity seems reasonable.

702.1 Boiler Fuel:
See Steam Account 712.

702.2 Water:
See Steam Account 712.

703. Fuel Under Retorts:
Entirely to Commodity.

704. Coal Carbonized:
Entirely to Commodity.

707.2 Retort House Supplies:
Entirely to Commodity.

707.2 Purification Supplies:
Entirely to Commodity.

707.3 Miscellaneous Works Expense:
This account should parallel account No. 701.6 and it is probable the same treatment given to that account would be reasonable.

707.4 Gas Storage:
Storage is necessary because of the variation of *demand,* and storage costs are naturally assigned to that column. It is put into the Distribution column rather than into the Manufacturing Demand because the purpose of storage is principally to take care of the variation in hourly demand within a 24-hour period.

708. Maintenance of Wks. & Sta. Structures:
This is a 100% Manufacturing Demand item. It is believed that all of this work is governed by the extent and character of the plant, rather than that it is proportionate to its output.

709.12 Maintenance Furnaces & Boilers:
709.13 Maintenance Boiler Apparatus:
709.14 Maintenance Steam Accessories:
See Steam Account 712.

709.15 Maintenance Steam Engines:
This item has partly a fixed character and partly a variable. In its allocation the note under 701.3 may be applied.

709.16 Maintenance Internal Combustion Engines:
709.17 Maintenance Miscellaneous Power Equipment:
709.21 Maintenance Benches and Retorts:
709.23 Maintenance Purification Apparatus:
Same comment as 709.15.

709.24 Maintenance of Holders:
100% Distribution Demand. Storage is necessary because of the variation of *demand,* and storage costs are naturally assigned to that column. It is put into the Distribution column rather than into Manufacturing Demand because the purpose of storage is principally to take care of the variation in hourly demand within a 24-hour period.

709.25 Maintenance of Accessory Works Equipment:
709.26 Maintenance of Laboratory Equipment:
709.27 Maintenance of Implements and Accessories:
See 709.15.

710. Gas from Other Sources:
Entirely variable — therefore, 100% Commodity.

711. Power from Other Sources:
Entirely variable — therefore, 100% Commodity.

712. Steam:
The uses for steam that do not vary with output should be allocated into the Manufacturing Demand column; balance to Commodity.

713. Residuals Produced:
714. Residual Expense:
715. Duplicate Production Charges-Cr.:
716. Production Expense Transferred-Cr.:
100% Commodity.

701. Works Superintendence:

This is clearly a Demand item. It is fixed by the size and character of the plant, the whole of which is operated in conformity with demand.

701.2 Boiler Labor:

See Steam Account 712.

701.4 Generator Labor:

There will probably be a fixed portion of generator labor that goes on regardless of whether output decreases. Insofar as this labor item can be kept proportionate to output it should go into the Commodity column. The fixed or standby portion should go into the Demand column. The following note indicates one method of apportioning.

Note: Certain expenses are not altogether proportional to output as they do not cease with a decrease in output but remain more or less constant with the capacity of plant. A crew of plant operators can not be discharged when output must be cut down with reduced demands. The maintenance of apparatus goes on just the same though output is curtailed. Usually such items are nevertheless put entirely into output. The suggestion is here made that there be charged to output a percentage of the total expense equal to the load factor percentage and place the remainder into Demand.

Thus, if a plant had an output for the period under analysis of 75% of the full time capacity then 75% of such an expense would go into output and the remainder to Demand. This will not be entirely accurate in all cases and the allocation may have to be adjusted by other factors.

701.5 Purification Labor:

Entirely to Commodity.

701.6 Miscellaneous Works Labor:

This item probably varies partly in direct proportion to Output, and partly remains constant. A division of 50% to Demand and 50% to Commodity seems reasonable.

702.1 Boiler Fuel:

See Steam Account 712.

702.2 Water:

See Steam Account 712.

705. Generator Fuel:

Entirely to Commodity.

706. Water Gas Oil:

Entirely to Commodity.

707.2 Generator House Expense:

Entirely to Commodity.

707.2 Purification Supplies and Expense:

Entirely to Commodity.

707.3 Miscellaneous Works Expense:

This account should parallel account No. 701.6 and it is probable the same treatment given to that account would be reasonable.

707.4 Gas Storage:

Storage is necessary because of the variation of *demand,* and storage costs are naturally assigned to that column. It is put into the Distribution column rather than into Manufacturing Demand because the purpose of storage is principally to take care of the variation in hourly demand within a 24-hour period.

708. Maintenance Works Structures:

This is a 100% Manufacturing Demand item. It is believed that all of this work is governed by the extent and character of the plant, rather than that it is proportionate to its output.

709.12 Maintenance Furnaces & Boilers:
709.13 Maintenance Boiler Apparatus:
709.14 Maintenance Steam Accessories:

See Steam Account 712.

709.15 Maintenance Steam Engines:

This item has partly a fixed character and partly a variable. In its allocation the note under 701.3 may be applied.

709.16 Maintenance Int. Combustion Engines:

709.17 Maintenance Miscellaneous Power Equipment:

709.22 Maintenance Water Gas Sets:

709.23 Maintenance Purification Apparatus:

Same comment as 709.15.

709.24 Maintenance of Holders:

100% Distribution Demand. Storage is necessary because of the variation of *demand,* and storage costs are naturally assigned to that column. It is put into the Distribution column rather than into Manufacturing Demand because the purpose of storage is principally to take care of the variation in hourly demand within a 24-hour period.

709.25 Maintenance of Accessory Works Equipment:

709.26 Maintenance of Laboratory Equipment:

709.27 Maintenance of Implements and Accessories:

See 709.15.

710. Gas from Other Sources:

Entirely variable — therefore 100% Commodity.

711. Power from Other Sources:

Entirely variable — therefore 100% Commodity.

712. Steam:

The uses for steam that do not vary with output should be allocated into the Manufacturing Demand column; balance to Commodity.

713. Residuals Produced-Cr.:

714. Residual Expense:

715. Duplicate Production Charges-Cr.:

716. Production Expense Transferred-Cr.:

100% Commodity.

DISTRIBUTION

721.1 Transmission Pumping:

The pro-rating of these expenses will depend upon the type of the gas distribution system and local load conditions. In such cases where all of the gas is pumped from the works to outlying holders, the pumping charge is a factor of the Commodity charge. In systems where boosters or high pressure compressors are used during peak hours, the charge is a factor of the Demand charge. In systems where all of the gas is delivered under high pressure, such part of the charge as is required to maintain a minimum pressure is a factor of the Commodity charge and the remainder is a factor of the Demand charge.

721.21 Distribution Superintendence:

This item applies to the distribution system as a whole and the supervision is distributed in the same proportion as the property itself is distributed for purposes of finding and distributing capital charges, as will be seen hereafter.

721.22 Distribution Supplies & Expense:

Same as under 721.21.

721.3 Consumers Premises Work:

This account is caused by the customer and should be allocated to the Customer Charge.

721.4 Removing and Resetting Meters:

This account is caused by the customer and should be allocated to the Customer charge.

722.1 Maintenance of Mains:

Same percentage distribution as physical property distribution.

722.2 Maintenance of Services:

Same percentage distribution as physical property distribution.

722.31 Maintenance Shop Buildings:

Same percentage distribution as physical property distribution.

722.32 Maintenance Distr. Imp. and Accessories:

Same percentage distribution as physical property distribution.

722.33 Maintenance Gas Appliances:

This account is caused by the customer and should be allocated to the Customer Charge.

723. Maintenance Consumers' Meters:

Same distribution as property.

724. Duplicate Distribution Charges:

These charges should be distributed according to their origin.

731. Operation of Street Lamps:

732. Maintenance of Street Lamps:

Same treatment as this class of property in the property allocation.

761.1 Commercial General Labor:

761.21 Commercial Bookkeeping:

761.22 Commercial Contracts:

761.31 Commercial Collecting:

761.32 Meter Reading:

761.4 Commercial Supplies & Expenses:

762. Agents' Commissions:

All expenses under the general heading of "Commercial Expenses" are for the benefit of customers and they are very closely proportionate to the number of customers and therefore go 100% into the Customer Column.

NEW BUSINESS EXPENSE

771.11 New Business Management Salaries:

771.12 New Business Advertising Salaries:

771.21 Demonstrations:

771.23 Advertising Supplies and Exp.:

771.24 Canvassing and Soliciting:

771.25 Miscellaneous New Business Supplies and Exp.:

These expenses include costs incurred for essential services to customers, which should be a customer charge; also expenses that are incurred for the purpose of stimulating commodity sales, which should be a Commodity Charge; and partly they are proportionate to demand, and a fair division would seem to be 50% to Customer, 12½% to each of the Demand Charges, and 25% to Commodity Charge.

GENERAL AND MISCELLANEOUS EXPENSES

781.11 Administrative Salaries:

781.12 General Office Salaries:

781.21 General Office Supplies and Exp.:

781.22 General Stationery and Printing:

781.23 Maintenance General Structures:

781.26 Law Expenses:

These expenses are of a mixed nature and apply to all the functions of the utility and may be equitably divided 50% to Customer, 12½% to Manufacturing Demand, 12½% to Distribution Demand, and 25% to Commodity.

781.27 Insurance:

Insurance expenses should be apportioned according to the kind of property on which this insurance is carried, in which the allocation of property will be a guide.

781.28 Stores Expenses:

Stores expenses should be allocated in the proportion that the stores are used, and to the columns into which the stores were assigned through the expense accounts.

781.29 Transportation Expenses:

These expenses should be assigned to the columns into which the operations incurring transportation expense have been placed.

781.30 Undistributed Adjustments:

Distributed according to their nature.

781.31 Rentals:

Distributed according to their nature.

781.32 Other Miscellaneous General Expenses:

Distributed according to their nature.

782. Retirement Expense:

This expense may be pro rated according to the allocation of physical property.

783. Injuries and Damages:

This may fairly be allocated as other general and miscellaneous expenses—50% to Customer, 12½% to Manufacturing Demand, 12½% to Distribution Demand, and 25% to Commodity.

784. Regulatory Commission Expense:
785. Relief and Welfare Work:
786. Franchise Requirements:
787. Amortization of Franchises:
788. Gas Expenses Transferred-Cr.:
789. Joint Operating Expenses-Cr.:
790. Duplicate Miscellaneous Charges-Cr.:

Same as other general and miscellaneous expenses—50% to Customer, 12½% to Manufacturing Demand, 12½% to Distribution Demand, and 25% to Commodity.

ALLOCATION OF FIXED CAPITAL

Organization.
Franchises.
Miscellaneous Intangible Capital.

These three accounts are allocated after all other fixed capital accounts and distributed in the proportion their allocations bear to each other—since they quite equally affect and give value to all classes of fixed capital.

Land (and Improvements)

Land has been allocated as have been the structures built upon it and according to the uses to which it is devoted. Gas works land—to Manufacturing Capacity. Land on which are distribution structures—to Distribution Capacity. The portion of land on which the barn and meter shop are located has been assigned one-half to customers and one-half to Distribution Capacity. Land occupied by holders has been assigned to Distribution Capacity; land occupied by Pumping Station has been assigned to Commodity. Land for general office is assigned to Customer.

Structures are distributed in accordance with the use to which devoted, as already explained under "land."

Plant Equipment

This has likewise been placed in accordance with the nature of the demand placed upon it, either to Manufacturing Capacity or to Distribution Capacity. Holders here included in plant equipment, have been assigned to Distribution Capacity.

General Equipment

This has likewise been classified according to the uses and demands placed upon it.

Mains

Transmission mains have been assigned to Distribution Demand.

Low pressure mains are distributed between Customer and Distribution Demand. There is assigned to Customer cost the average cost of 4-inch pipe (minimum size) applied to the total mileage of distribution mains; the balance being assigned to Distribution Demand.

District Governors are assigned to Distribution Demand.

Services

Service pipes being devoted to the individual use of the customer or a few customers, are assigned to the Customer column, except that the excess cost over the ordinary size service pipe is assigned to Distribution Demand.

Service Governors are assigned to Customers.

Meters (includes Settings and Connections)

Meters are assigned to Customer except that the cost in excess of the average for five light meter (minimum size) is assessed to Distribution Demand.

Street Lighting Equipment

Where this is an extensive system it presents a problem in cost analysis by itself.

Materials and Supplies

These accounts were classified and those pertaining to Manufacturing plant, such as parts and tools, charged to Manufacturing Demand. Parts and tools for Distribution plant—to Distribution Demand; merchandise and office supplies—to Customer, and Manufacturing materials and fuel—to Commodity.

The total of fixed capital thus distributed is then used as the basis for a pro rata distribution of retirement expense, taxes, and return on investment.

TABLE I

SUMMARY OF FOUR PART COSTS

	Total	Per M Cu. ft.	Customer Cost	Per M Cu. ft.	Manufacturing Demand	Per M Cu. ft.	Distribution Demand	Per M Cu. ft.	Commodity	Per M Cu. ft.
Production	$2,561,407.86	.4646			$100,000.00	.0181	$ 10,000.00	.0018	$2,451,407.86	.4447
Distribution	442,730.89	.0803	$ 261,500.00	.0474			161,730.89	.0293	19,500.00	.0035
Municipal Lighting	373.74								373.74	—
Commercial	194,167.64	.0352	194,167.64	.0352						
New Business	48,955.94	.0088	24,955.94	.0045	6,000.00	.0011	6,000.00	.0010	12,000.00	.0022
General	147,042.23	.0266	73,462.23	.0133	18,395.00	.0033	18,395.00	.0033	36,790.00	.0067
Retirement Expense	225,000.00	.0408	81,000.00	.0146	83,000.00	.0150	61,000.00	.0111		
Taxes	651,605.00	.1182	150,000.00	.0272	154,000.00	.0279	111,176.60	.0202	236,428.40	.0429
Return on Investment	1,350,000.00	.2448	485,000.00	.0881	500,000.00	.0907	365,000.00	.0662		
	$5,621,283.30	1.0193	$1,270,085.81	.2303	$861,395.00	.1561	$733,302.49	.1329	$2,756,500.00	.5000
Capacities			112,070		20,000,000		2,400,000		5,513,000 M	
			Average No. of Customers		Cubic Feet per 24 hrs.		Cubic Feet per hour		Cubic Feet Sales year 1922	
Unit Costs			$11.34 per annum per customer		$4.30 per annum per 100 cu. ft. of 24 hr. demand		$30.54 per annum per 100 cu. ft. of hourly demand		$ .50 per M cubic feet	
			$ .95 per month		$ .36 per month		$2.50 per month			
							66.44 per 100 feet of hourly demand			

PRODUCTION

Note: A distribution of production accounts was made in detail, but is not here shown, but instead a result has been assumed that would be more nearly representative.

TABLE II

APPORTIONMENT OF OPERATING EXPENSES

		1922	Customer	Manufacturing Demand	Distribution Demand	Commodity
Production		$2,561,407.86		$100,000.00	$10,000.00	$2,451,407.86
*Distribution**						
721.21	Superintendence—Distr. to Constr. & Operation					
721.4	Labor removing and resetting meters	12,802.90			12,802.90	
721.21	Street Department Labor	23,943.29	$ 14,400.00		9,543.29	
721.21	Meter and Fittings Dept. Labor	22,196.64	19,300.00		2,896.64	
721.3	Customers' Premises Expenses	64,251.12			64,251.12	
721.1	Pumping Gas	39,188.06			19,688.06	19,500.00
721.22	Street Dept. Supplies and Expenses	16,612.46	10,000.00		6,612.46	
721.22	Meter and Fittings Dept. Supplies and Expenses	23,762.17	20,600.00		3,162.17	
	Total Operation	$202,756.64				
Maintenance						
722.1	Mains	$27,272.68	$ 16,200.00		$ 11,072.68	
722.2	Services	70,810.53	61,000.00		9,810.53	
723.	Meters	139,648.61	120,000.00		19,648.61	
722.3	Distribution Bldgs., Fixt. and Grounds	2,242.43			2,242.43	
	Total Maintenance	$239,974.25				
	Total Distribution	$442,730.89	$261,500.00		$161,730.89	$19,500.00
Municipal Contract Lighting						
Maintenance						
732.	Municipal Contract Lighting System	$373.74				$373.74
Commercial						
761.21	Collection Salaries and Commissions	$139,423.57	$139,423.57			
761.32	Reading Meters and Delivering Bills	33,406.78	33,406.78			
761.4	Collection Supplies & Expenses	18,139.46	18,139.46			
	Uncollectible Accts. (Reserve Charge)	3,197.83	3,197.83			
	Total Commercial	$194,167.64	$194,167.64			
New Business						
771.1	Promotion of Business Salaries & Commissions	$28,284.71	$14,284.71	$3,500.00	$3,500.00	$7,000.00
771.2	Promotion of Business Supplies and Expenses	20,671.23	10,671.23	2,500.00	2,500.00	5,000.00
	Total New Business	$48,955.94	$24,955.94	$6,000.00	$6,000.00	$12,000.00

*The distribution items of 721.21 to 721.22 were transposed in error. Those appearing in the column "Customer" should have been set up in the column "Distribution Demand" and vice versa. This makes only a slight difference in the results and as it was discovered late, the tabulation was not corrected.

TABLE II—*Continued*

APPORTIONMENT OF OPERATING EXPENSES

		1922	Customer	Manufacturing Demand	Distribution Demand	Commodity
General						
Operation						
781.11	Salaries of General Officers	$ 58,600.00	$29,300.00	$7,325.00	$7,325.00	$14,650.00
781.12	Salaries of General Office Clerks	26,069.47	13,069.47	3,250.00	3,250.00	6,500.00
781.31	General Office Rent	6,041.86	3,041.86	750.00	750.00	1,500.00
781.2	General Office Supplies and Expenses	15,045.99	7,545.99	1,875.00	1,875.00	3,750.00
781.26	Law Expenses—General	5,000.00	2,500.00	625.00	625.00	1,250.00
781.32	Miscellaneous General Expenses	21,776.30	10,976.30	2,700.00	2,700.00	5,400.00
784.	Railroad Commission Expenses	851.75	451.75	100.00	100.00	200.00
	Total Operation	$133,385.37				
Maintenance						
	General Office Equipment	$ 772.05	$ 392.05	$ 95.00	$ 95.00	$ 190.00
781.23	General Office Bldgs., Fixt. and Grounds	3,446.31	1,746.31	425.00	425.00	850.00
	Total Maintenance	$ 4,218.36				
	Total	$137,603.73	$69,023.73	$17,145.00	$17,145.00	$34,290.00
Less Supervision development charge to Wau. & W.A.Gas Co.		18,561.50	9,561.50	2,250.00	2,250.00	4,500.00
	Total General	$119,042.23	$59,462.23	$14,895.00	$14,895.00	$29,790.00
Undistributed						
783.	Injuries and Damages	$28,000.00	14,000.00	3,500.00	3,500.00	7,000.00
			$73,462.23	$18,395.00	$18,395.00	$36,790.00
	Retirement Expense	225,000.00	81,000.00	83,000.00	61,000.00	
			36%	37%	27%	
	Taxes Property	415.176.60	150,000.00	154,000.00	111,176.60	236,428.40
	Taxes Income	236,428.40				
	Return 8%	1,350,000.00	485,000.00	500.000.00	365,000.00	

TABLE III

Apportionment of Property as of December 31, 1922
According to the Uses and Demands to Which Each Portion is Subject

		Property	Customers	Production Demand	Distribution Demand	Commodity
301	Organization } Placed after					
302	Franchises } Tangible					
303	Miscl. Intangible Capital } Property					
311	Land and Improvements—Third Ward Plant	$ 607,760.79	$ 61,201.51	$ 485,357.77	$ 61,201.51	
	—West Side Plant	1,003,919.00		893,086.34	110,832.66	
	—General Office	163,872.70	163,872.70			
312	Structures—Third Ward Plant	485,254.03	50,466.42	304,691.00	130,096.61	
	—West Side Plant	744,586.52		718,228.16	26,358.36	
	—General Office	168,645.66	60,000.00	60,000.00	48,645.66	
313 to 320	Plant Equipment—Third Ward Plant	1,616,452.78		1,313,529.53	302,923.25	
	—West Side Plant	2,458,090.10		1,562,362.07	895,728.03	
	—Tar Plant & Miscl.	109,778.78		109,778.78		
327	General Equipment	246,604.51	134.498.10	84,659.33	27,447.08	
321	Mains—High Pressure Transmission	1,097,787.81			1,097,787.81	
	—Low Pressure Transmission	3,667,247.69	2,892,724.98		774,522.71	
	—Valves—Valve Pits	71,594.86			71,594.86	
	—District Governors—Transmission	97,050.81			97,050.81	
322	Services	1,059,603.89	919,100.42		140,503.47	
	—Service House Governors	9,545.98	9,545.98			
323	Consumers' Meters (Incl. 324)	1,295,071.42	1,143,807.08		151,264.34	
325	Street Lighting Equipment	6,363.99				$ 6,363.99
	Total Tangible Fixed Capital	$14,909,231.32	$5,435,217.19	$5,531,692.98	$3,935,957.16	$ 6,363.99
328 to 359	Distributed in the Above Percentages		36.46	37.10	26.40	.04
301 to 303	Organization Franchises	1,000,737.00	364,168.19	371,273.42	264,194.57	1,100.82
	Miscl. Intangible Capital	38,013.51	38,013.51			
		$15,947,981.83				
116	Materials and Supplies	991,845.17	127,039.23	63,033.41	105,303.98	696,468.55
	Total Capital	$16,939,827.00	$5,964,438.12	$5,965,999.81	$4,305,455.71	$703,933.36
	Percentages		35.15	35.22	25.42	4.14

TABLE IV

Application of Demand, Customer and Commodity Costs to Customers
Grouped by Monthly Consumption

COSTS	
Mfg. Demand Per 100 Cu. Ft.	$ .36 per Mo.
Distr. Demand Per 100 Cu. Ft.	2.50 " "
Customers Charge Per Consumer	.95 " "
Commodity Charge	.50 per M.

1 Monthly Consumption Group	2 Observed 24 hr. Demand	3 Diversity Factor	4 Assessed Demand	5 No. of Monthly Bills	6 Total 24 hr. Demand (12 times) Col. 4 x Col. 5	7 Mfg. Demand Rate Per Consumer Per Month @ .36 Per 100 Cu. Ft.	8 Mfg. Demand Costs Col. 5 x Col. 7	9 Observed Hourly Demand	10 Diversity Factor
.0 — 400	30	2.	15	63,059	945,885	.054	$ 3,405.19	30	6.
.4 — 1000	75	1.5	50	96,253	4,812,650	.180	17,325.54	36	6.
1. — 2000	120	1.5	80	313,202	25,056,160	.288	90,202.18	60	6.
2. — 3000	170	1.3	130	362,656	47,145,280	.468	169,723.00	70	5.
3. — 4000	204	1.3	157	236,317	37,101,769	.5652	133,566.37	80	4.5
4. — 5000	260	1.2	216	120,186	25,960,176	.7776	93,456.63	80	3.5
5. — 6000	324	1.2	270	59,034	15,939,180	.972	57,381.05	90	3.5
6. — 7000	372	1.2	310	30,497	9,454,070	1.116	34,034.65	100	3.1
Sub-total									
7. — 8000	400	1.2	333	16,939	5,640,687	1.1988	20,306.47	110	2.5
8. — 9000	425	1.2	354	10,536	3,729,744	1.2744	13,427.08	120	2.5
9. — 10000	460	1.2	383	7,319	2,803,177	1.3788	10,091.44	130	2.5
Sub-total									
10. — 15000	600	1.2	500	17,695	8,847,500	1.80	31,851.00	140	2.5
15. — 20000	900	1.2	750	6,103	4,577,250	2.70	16,478.10	180	2.5
Sub-total									
20. — 100000	1,750	—	1,750	10,733	18,782,750	6.30	67,617.90	352	2.
100. — 200000	5,800	—	5,800	1,181	6,849,800	20.88	24,659.28	1,144	2.
Over — 200000	21,600	—	21,600	1,098	23,716,800	77.76	85,380.48	4,360	2.
Total				1,352,808	240,850,226		$868,906.36		

TABLE IV—*Continued*

Application of Demand, Customer and Commodity Costs to Customers Grouped by Monthly Consumption

	11 Assessed Demand	12 Total Hourly Demand (12 times) Col. 11 x Col. 5	13 Distr. Demand Rate Per Consumer @ $2.50 Per 100 Cu. Ft.	14 Distr. Demand Cost Col. 5 x Col. 13	15 Consumer's Charge @ .95 Per Consumer	16 Gas Used Cubic Ft.	Gas Used Amount @ .50 Per M Cu. Ft.
.0 — 400	5	315,295	.125	$ 7,882.38	$ 59,906.05	10,171,700	$ 5,085.85
.4 — 1000	6	577,518	.150	14,437.95	91,440.35	75,103,800	37,551.90
1. — 2000	10	3,132,020	.250	78,300.50	297,541.90	500,536,100	250,268.05
2. — 3000	14	5,077,184	.350	126,929.60	344,523.20	917,932,100	458,966.05
3. — 4000	18	4,253,706	.450	106,342.65	224,501.15	827,599,400	413,799.70
4. — 5000	23	2,764,278	.575	69,106.95	114,176.70	539,672,800	269,836.40
5. — 6000	26	1,534,884	.650	38,372.10	56,082.30	324,325,800	162,162.90
6. — 7000	32	975,904	.800	24,397.60	28,972.15	198,161,500	99,080.75
Sub-total						3,393,503,200	
7. — 8000	44	745,316	1.100	18,632.90	16,092.05	127,127,600	63,563.80
8. — 9000	48	505,728	1.200	12,643.20	10,009.20	89,740,500	44,870.25
9. — 10000	52	380,588	1.300	9,514.70	6,953.05	69,725,100	34,862.55
Sub-total						3,680,096,400	
10. — 15000	56	990,920	1.400	24,773.00	16,810.25	213,008,000	106,504.00
15. — 20000	72	439,416	1.800	10,985.40	5,797.85	104,752,100	52,376.05
Sub-total						3,997,856,500	
20. — 100000	176	1,889,008	4.400	47,225.20	10,196.35	424,048,700	212,024.35
100. — 200000	572	675,532	14.300	16,888.30	1,121.95	157,889,600	78,944.80
Over — 200000	2,180	2,393,640	54.500	59,841.00	1,043.10	701,338,200	350,669.10
Total		26,650,937		$666,273.43	$1,285,167.60	5,281,133,000	$2,640,566.50

TABLE IV—*Continued*

SUMMARY

	Manufacturing Demand Cost	Distribution Demand Cost	Consumer's Cost	Commodity Cost	Total Cost	% of Total	Cost Per M. Cu. Ft	Amount of Monthly Cost Per Customer
.0 — 400	$ 3,405.19	$ 7,882.38	$ 59,906.05	$ 5,085.85	$ 76,279.47	1.40	7.499	1.43
.4 — 1000	17,325.54	14,437.9	91,440.35	37,551.90	160,755.74	2.94	2.140 } 2.78	1.67
1. — 2000	90,202.18	78,300.50	297,541.90	250,268.05	716,312.63	13.12	1.431	2.48
2. — 3000	169,723.00	126,929.60	344,523.20	458,966.05	1,100,141.85	20.15	1.198	3.05
3. — 4000	133,566.37	106,342.65	224,501.15	413,799.70	878,209.87	16.08	1.061	3.71
4. — 5000	93,456.63	69,106.95	114,176.70	269,836.40	546,576.68	10.01	1.013	4.55
5. — 6000	57,381.05	38,372.10	56,082.30	162,162.90	313,998.35	5.75	.968	5.30
6. — 7000	34,034.65	24,397.60	28,972.15	99,080.75	186,485.15	3.41	.941	6.10
Sub-total and average					$3,978,759.74	72.86	1.172	3.10
7. — 8000	20,306.47	18,632.90	16,092.05	63,563.80	118,595.22	2.17	.933	6.94
8. — 9000	13,427.08	12,643.20	10,009.20	44,870.25	80,949.73	1.48	.902	7.70
9. — 10000	10,091.44	9,514.70	6,953.05	34,862.55	61,421.74	1.13	.881	8.35
Sub-total and average					$4,239,726.43	77.64	1.152	3.22
10. — 15000	31,851.00	24,773.00	16,810.25	106,504.00	179,938.25	3.29	.845	10.20
15. — 20000	16,478.10	10,985.40	5,797.85	52,376.05	85,637.40	1.57	.818	14.00
Sub-total and average					$4,505,302.08	82.50	1.127	3.36
20. — 100000	67,617.90	47,225.20	10,196.35	212,024.35	337,063.80	6.17	.795	31.30
100. — 200000	24,659.28	16,888.30	1,121.95	78,944.80	121,614.33	2.23	.770	103.00
Over — 200000	85,380.48	59,841.00	1,043.10	350,669.10	496,933.68	9.10	.708	450.00
Total	$868,906.36	$666,273.43	$1,285,167.60	$2,640,566.50	$5,460,913.89	100.00	1.034	4.03

DISCUSSION OF ANALYSIS

The foregoing principles and methods employed in the analysis of a set of accounts for 1922 resulted in the following unit costs: $4.30 per annum, per hundred cubic feet of manufacturing capacity demanded; $30.54 per annum per hundred cubic feet of distribution capacity demanded; $11.34 per annum per customer; $.50 per thousand cubic feet of gas used. If the demand costs, both for manufacturing capacity and distribution capacity, be added together and reduced to unit costs by using as a divisor the maximum hourly rate of distribution, then the sum of $66.44 per hundred feet of hourly demand is arrived at. This latter method of combining all demand costs, and rating them by the maximum hourly rate of demand does not correctly reflect the true situation as to costs (as will be shown by some examples of the application of both methods).

We have already shown in the foregoing pages the reasons for determining separately the costs of demand on Manufacturing Capacity, i. e. because the capacity of the gas works is determined by the maximum daily demand while only the capacity of distribution system is determined by the hourly demand. It is sometimes contended that the 24-hour demand is a function of the hourly demand, but this conclusion is fundamentally wrong if the analysis of costs is to correctly reflect the facts as they exist.

The error here lies in neglecting the fact that the size of production plant is such as will produce over a twenty-four hour period, the maximum requirement for such period whereas at the same time the distribution plant must be of a capacity that will deliver the amount required at the moment of maximum demand. Now the maximum demand on distribution system does not as a rule fall within the maximum twenty-four hour period and that is one reason the former is not a constant function of the latter. Moreover, if manufacturing plant and distribution plant costs are combined and rated by the maximum hourly delivery, that is equal to assuming that the manufacturing plant has an *hourly* capacity equal to the hourly demand on the distribution system. Or if the two together were rated by the capacity of the manufacturing plant to produce within one hour, then the distribution plant would be rated at much too low a capacity, and the combined cost is much too high because of too low a rating. Obviously the two cannot be rated on the same basis. Moreover, uses of gas vary so in load factors and characteristics of the two demands that an analysis which does not differentiate between Manufacturing Demand and Distribution Demand does not reflect the essential difference in costs brought about by such differing characteristics.

In order to illustrate that it makes a difference as to which method shall be adopted, a concrete example is taken of two customers of about the same annual use of gas, but with very different characteristics as to load, and we have applied to each, under "A," the four part unit costs, and under "B," the three part unit costs, found by combining Manufacturing and Distribution Demand Costs and rating by the hourly demand.

COMPARISON OF RESULTS IN APPLYING DEMAND, CUSTOMER, AND COMMODITY COSTS

(a) Applying unit Manufacturing Demand costs to maximum twenty-four hour use and unit Distribution Demand Costs to maximum hourly use, adding thereto Customer Charge and Commodity Charge. The costs here

applied are as found by the method of analysis furnished herewith.

(b) Applying a unit of demand cost as found by *combining* Manufacturing and Distribution demand costs in the analysis, and dividing the total by maximum *hourly* demand on plant. The unit cost thus found is $66.44 per 100 ft. of hourly demand.

The following comparison is between two customers of opposite characteristics as to load factor and diversity factor:

The first is a customer who heated his house by gas exclusively. It was a house of 30,000 cu. ft. contents and the demand and use shown herein are typical of househeating in this climate.

The second is a small restaurant. Their characteristics are:

In studying the above comparison we have before us, in the restaurant customer, a class of business with perhaps the best load factor of all our customers. In contemplating the househeating customer we should bear in mind that here we have a use of gas which, if it can be taken on, is of unlimited proportions. We will do well, therefore, to study the characteristics of this class of business.

In the example above, under method "a," the average cost per thousand cubic feet of gas used throughout the year for househeating would be $1.14, whereas for the restaurant use, by the same method, a ten per cent smaller amount would cost $.80. Under "b" method of cost

	I House Heating	II Restaurant
Hourly demand at rate of max. 15 min.	185 cu. ft.	160 cu. ft
Maximum 24 hour use	4,000 cu. ft.	950 cu. ft.
Consumption during maximum month	100,000 cu. ft.	25,900 cu. ft.
Consumption during entire 12 months	370,000 cu. ft.	330,700 cu. ft.
No. of days use per annum of max. 24 hr. use	92 days = 25% load factor	350 days = 96% load factor
No. of hrs. use per annum of max. hourly rate	2,000 hrs. = 23% load factor	2,060 hrs. = 23% load factor

Examples of Cost Figuring

		Cost	Per M
Househeating	(a)		
Customer Cost	@ 11.34 =	11.34	.0306
Mfg. Demand	40.00 x 4.30 =	172.00	.4650
Distr. Demand	1.85 x 30.54 =	56.50	.1527
Commodity	370,000 cu. ft. @ 50c =	185.00	.5000
		424.84	1.1483
	(b)		
Customer Cost	@ 11.34 =	11.34	.0306
"Demand"	1.85 x 66.44 =	122.91	.3322
Commodity	370,000 cu. ft. @ 50c =	185.00	.5000
		319.25	.8628
Restaurant	(a)		
Customer Cost	@ 11.34 =	11.34	.0343
Mfg. Demand	9.50 x 4.30 =	40.85	.1235
Distr. Demand	1.60 x 30.54 =	48.36	.1477
Commodity	330,700 x .50 =	165.35	.5000
		266.40	.8055
	(b)		
Customer Cost	@ 11.34 =	11.34	.0343
"Demand"	1.60 x 66.44 =	106.31	.3215
Commodity	330,700 x .50 =	165.35	.5000
		283.00	.8558

finding both uses would seem to cost $.86 and $.85 respectively. The question is, therefore, can method "b" be right when by applying the elements of cost to two customers, one demanding about four times as much manufacturing plant capacity as the other, and the two nearly equal as to their distribution demand, their annual costs will be about equal?

CUSTOMER, DEMAND, AND COMMODITY COSTS APPLIED

If the four parts are the true cost factors we ought in some way apply them to the sales of gas to all customers in order to note what would be the effect on gas bills if all customers paid on this cost basis. Obviously it would be impossible to apply costs to each individual customer for we should have to know the maximum momentary demand of each customer as well as his maximum 24 hour demand. The nearest approximation that can be made is to deal with customers as classified by steps of monthly consumption. Where an analysis of all gas bills has been made, a table may be constructed of the number of customers in each step of 1000 cubic feet of monthly consumption, and to each group the demands may be assigned with a reasonable degree of approximation to actual facts.

For a guide in the assignment of demands to each such group, the demands shown by recording meter records may be used, where such are available. It is well known that such demands will have to have applied to them certain diversity factors before the cost rates can be applied and such diversity factors must be a matter of judgment. The customers in the groups of small consumption will obviously be entitled to the larger diversity factors, because it is their less regular use of gas that accounts for their smaller monthly consumption.

In Table IV a computation is made of the cost of serving the average customer in groups of monthly consumption. The observed demands for each group are taken from recording meter records tabulated for some years back and from special observations of large users. Load factors were studied for the various groups and compared with plant load factors, and diversity factors deduced which seemed to be reasonable. The table shows how, step by step, the demand costs are applied to the demands assigned to each group, and customer and commodity costs added. The total costs in each group divided by the number of bills in each group give the cost for the average customer in each group, while the total cost divided by the total cubic feet in each group gives the average cost per thousand cubic feet for each group.

PRACTICAL APPLICATION OF COST STUDIES TO RATE MAKING

What practical lessons can be learned from cost analysis, and what part of it can be applied in rate making?

Undoubtedly the outstanding and challenging feature brought out is that there are such large *customer costs*. The average gas utility furnishes service to about 95% of its customers, supplying them with an *average* of less than 3,000 cu. ft. per month. This consumption, at the rate of $1.25 per thousand, would bring a revenue of $3.75 of which $.95, or 25%, is customer cost. On a 2,000 cu. ft. per month consumption @ $1.25, the bill would be $2.50, and the customer cost of $.95 would be 38%. On a thousand cu. ft. consumption the customer cost of $.95 would be 76%. This shows how little there is left out of the revenue from these small customers for the rest of the services with which they are furnished and which they demand.

Some progress is being made in the recognition of these costs in making rates, as for example in the fixed charges that have frequently been called "service charge," though they are really a customer charge. In other instances the customer cost has been partly recognized by putting it into the rate for a small initial quantity of gas as for instance a rate of $.60 for the first 400 cu. ft. Of course the customer cost is only slightly recognized in these cases and in consequence the rate for gas for subsequent quantities must be kept higher to absorb the customer costs.

STEP (OR BLOCK) RATE

An example of construction of a step rate is shown in the following illustration. It was first assumed that 75c per month should be the amount below which no bill would be rendered and that it was policy to furnish 400 cu. ft. of gas with such charge and that thus the customer costs would be partially covered in the first block. This initial charge then is for the first 400 ft. per month for all customers.

Consumption above 400 ft. was to be started with a rate of $1.00 per M, which of course would be insufficient for the lower steps of consumption, if the costs were to be covered. The costs by steps were copied from the cost analysis applied as in Table IV and then step by step the revenue computed using the rate 75c for the first 400 ft. and $1.00 per M after that.

At the 7,000-foot step, although the costs up to that point had not been covered by revenue, it was decided to effect a cut in the step rate and carry the deficit farther. The rate for the group from 7,000 to 20,000 was: first 400 ft. 75c; next 6,600 at $1.00 per M; next 13,000 90c per M. The rates as used in the illustration carry some of the deficit from the low rate of $1.00 per M for the second step right on through all the subsequent steps as will be observed by comparing costs at each step with revenue at the same point.

The rate curve produced by this step rate does not follow the cost curve as well as it should and it places the burden of deficit from customers in the steps of small consumption on those in the groups of larger consumption in proportion to their larger use of gas and so does not present to the latter the inducement to use additional gas as cheaply as they might have it if they were not bearing that burden.

RATE MAKING FOR LARGE CUSTOMERS

The application to larger users of the four-part system is not impractical in view of the revenue involved and load factors here encountered. In the absence of momentary demand limiting devices or demand recording instruments for such large users, some practical methods could be employed for determining the demand factors. For example, a rule might be made:

The demand factors shall be found as follows:

(a) *Twenty-four Hour Demand Factor:* The maximum monthly consumption in any of the six winter months last preceding, divided by 30. In no case less than one-half the maximum monthly consumption in any month of the twelve months last preceding divided by 30. Factor to remain constant for the calendar year.

(b) *Hourly Demand Factor*: 75% (25% off for diversity) of connected load of appliances at their hourly rating.

TABLE V

Application of Step Rate

1st	400		.75	
next	6600	@	1.00	per M
"	13000	@	.90	" "
"	80000	@	.80	" "
"	100000	@	.70	" "
Over	200000	@	.68½	" "

	Cost	Percent of Total Cost	Cost Per M	Ave. Cost Per Customer Per Month	Total Revenue at Above Rate	Percent of Total Revenue	Ave. Rate Per M	Ave. Monthly Bill	Average Cu. Ft.	Revenue to Cost Over—Short	Block Rate Revenue Per Bill Over—Short	Ave. Monthly Bill at Flat Rate $1.03	Flat Rate Revenue Per Bill Over—Short
.0 — 400	$ 76,279.47	1.4	7.49	1.23	$ 47,294.25	.8	4.66	.75	(160)	$ 28,985.22	.46	.16	1.07
.4 — 1000	160,755.74	2.8	2.14	1.66	108,792.35	1.9	1.44	1.12	(780)	51,963.39	.54	.80	.86
1. — 2000	716,312.63	13.2	1.43	2.28	610,156.80	11.2	1.22	1.94	(1600)	106,155.83	.34	1.65	.63
2. — 3000	1,100,141.85	20.3	1.19	3.05	1,044,861.70	19.	1.14	2.88	(2500)	55,280.15	.15	2.58	.47
3. — 4000	878,209.87	16.2	1.06	3.71	910,310.35	16.7	1.10	3.85	(3500)	32,100.48	.13	3.60	.11
4. — 5000	546,576.68	10.0	1.01	4.55	581,737.90	10.7	1.07	4.85	(4500)	35,161.22	.29	4.64	.09
5. — 6000	313,998.35	5.7	.97	5.30	344,987.70	6.3	1.06	5.82	(5500)	30,989.35	.52	5.67	.37
6. — 7000	186,485.15	3.4	.94	6.10	208,835.45	3.8	1.05	6.85	(6500)	22,350.30	.73	6.70	.60
Sub-total	$3,978,759.74	73.	1.17		$3,856,976.50	70.4	1.13			$121,783.24	.09		
7. — 10000	260,966.69	4.5	.91	7.50	294,476.58	5.4	1.02	8.45	(8200)	33,509.89	.96	8.45	.95
Sub-total	$4,239,726.43	77.5	1.15		$4,151,453.08	75.8							
10. — 20000	265,575.65	4.8	.835	11.15	310,971.99	5.7	.98	13.00	(13300)	45,396.34	1.90	13.70	2.55
Sub-total	$4,505,302.08	82.3	1.12		$4,462,425.07	81.5							
20. — 100000	337,063.80	6.2	.795	31.30	374,218.06	6.9	.88	35.00	(39400)	37,154.26	3.40	40.58	9.28
Sub-total	$4,842,365.88	88.5	1.09		$4,836,643.13	88.5							
100. — 200000	121,614.33	2.2	.770	103.00	125,734.77	2.4	.79	106.00	(133000)	4,120.44	3.50	136.99	33.99
Sub-total	$4,963,980.21	90.7	1.08		$4,962,377.90	90.0							
Over — 200000	496,933.68	9.3	.708	452.00	498,039.56	9.1	.71	453.00	(640000)	1,105.88	1.00	670.00	218.00
	5,460,913.89	100.—	1.03		$5,460,417.46	100.—							

TABLE VI

Four Part Costs Applied to Industrial Customers

* COSTS
$ 4.30 per annum per 100 cu. ft. of Manuf. Demand
30.54 " " " " " Distr. "
11.34 " " " Customer
.50 " " 1000 cu. ft. of gas

Industry	Meters Size	Total Meter Capacity Cu. Ft.	Cu. Ft. 24 hr. Mfg. Demand	Cu. Ft. Hourly Distr. Demand	Max. Monthly Consumption 1922	Annual Consumption 1922	Mfg. Annual Load Factor %	Distr. Annual Load Factor %	Mfg. Demand Cost For Year	Rate Per M Cu. Ft.	Distr. Demand Cost For Year	Rate Per M Cu. Ft.	Commodity Cost @ 50c	Total Cost Incl. Customer Cost	Total Cost Per M Cu. Ft.
Hotel & Restaurant	2–60s	2,600	17,000	2,000	511,400 Nov.	5,237,000	83	30	$ 731.00	.1396	$ 610.80	.1166	$ 2,618.00	$ 3,971.14	.7582
do	1–100	1,800	17,000	1,400	527,500 Dec.	5,083,000	82	41	731.00	.1438	27.56	.0841	2,546.50	3,716.40	.731
do	2–60	2,600	20,000	1,700	613,500 Dec.	6,270,700	85	42	860.00	.1372	519.18	.0828	3,135.00	4,525.52	.7218
do	2–200reg.	3,000	23,000	2,800	587,400 Dec.	6,121,100	73	25	989.00	.1616	855.12	.1396	3,060.50	4,915.96	.803
do	1–30 1–60	1,930	22,000	2,200	624,800 Mch.	7,929,000	100	47	946.00	.1193	671.88	.0846	3,964.50	5,593.72	.7052
Newspaper	1–45 2–60	1,800	20,000	1,200	613,600 Dec.	5,886,700	80	56	860.00	.1461	366.48	.0622	2,943.35	4,181.17	.7104
do	3–60	4,000	25,000	2,400	756,300 Dec.	8,619,400	95	41	1,075.00	.1247	732.96	.0850	4,309.70	6,117.66	.7096
Brass Founder	1–60 5–200	17,000	96,000	16,000	2,899,600 Dec.	25,497,500	83	18	4,128.00	.1619	4,886.40	.1916	12,748.75	21,774.49	.854
Lamp Mfg.	10–60	13,000	55,000	9,000	1,630,300 Dec.	16,426,700	80	20	2,365.00	.144	2,784.60	.1695	8,213.35	13,374.29	.814
Heat Treating	3–60 2–100	7,500	29,000	7,000	886,200 Aug.	6,449,700	60	10	1,247.00	.1933	2,137.80	.3314	3,224.85	6,620.99	1.026
Heat Treating, etc.	6–100	18,000	49,000	5,400	1,477,600 Sept.	11,325,700	63	24	2,107.00	.186	1,649.16	.1456	5,662.85	9,430.35	.833
Enameling	2–60 1–80 2–200	9,400	86,000	5,400	2,622,300 Oct.	23,391,600	73	49	3,698.00	.1581	1,649.16	.0705	11,695.80	17,054.30	.729
Coffee Roasting	1–45 1–60	1,800	15,000	2,400	450,600 Dec.	4,054,600	73	19	645.00	.1592	732.96	.1809	2,027.30	3,416.60	.843
do	1–30 2–60	3,500	8,400	2,300	254,700 Dec.	2,492,800	81	12	361.20	.145	702.42	.282	1,246.40	2,321.36	.932
Melting, etc.	5–150	6,000	22,000	1,600	663,500 Nov.	4,761,300	60	34	946.00	.1987	488.64	.1025	2,380.65	3,826.63	.8034
Boiling Varnish	6–200	18,000	43,000	9,000	1,297,300 Oct.	12,734,700	80	13	1,849.00	.1453	2,748.60	.2159	6,367.35	10,976.29	.862
	Totals		547,400	71,800		152,281,500			$23,538.20	.1546	$21,963.72	.1442	$76,144.85	$121.816.87	.80

(This assumes that actual hourly demand on station has been used as divisor to obtain unit cost.)

Rate Schedule:

The monthly charges shall be computed as follows:

A customer charge of $.95.

A demand charge amounting to $.36 per month per 100 feet of twenty-four hour demand, plus $2.50 per 100 feet of distribution demand, both demands determined as above.

A commodity charge at the rate of $.50 per thousand cubic feet of gas consumed.

(This is using the figures found in the analysis above.)

An application of above schedule of rates is applied to certain industrial customers on Table VI.

Some study and experience would be needed on the part of the rate maker to give effect to the proper diversity factor according to the class of business and the characteristics of the demand. Rate systems used in the electric service present a technique based on many years of experience which will be valuable as a guide in rate making for gas supply based on cost of service.

APPENDIX B

SHORT DISCUSSION ON THE ALLOCATION OF COSTS

G. I. VINCENT, Syracuse, N. Y.

The three-part and four-part cost analyses as bases for rate structures are the most accurate that have been devised up to this time. But, generally speaking, only some extraordinary event could bring about their immediate adoption in a well-operated utility that was earning a fair return on its value. In other words, while we must depend on these analyses for our allocations, when we come to the point of applying a more equitable rate than we now have, it is doubtful if, at this time, they can be used as a whole. This should not be construed as implying that a three or four-part rate can never be applied in the manufactured gas industry. Far from it. We are discussing *present* conditions only in this appendix, that is, the year 1923. Looking into the future, it seems reasonably certain that more equitable rate structures must necessarily be established. In the meantime, we recommend using every expedient that will progress toward more equitable rates.

Never lose sight of the fact that the flat, or nearly flat rate is a very serious handicap to the industry.

It is a reasonable statement that we can not educate the man on the street to the intricacies of a complete cost analysis and this statement may be extended to include a substantial fraction of the interested authorities. Many have therefore concluded that it is impossible to progress by education. Such a conclusion should not be admitted for a moment. Education is vitally necessary, because with the possible exception of a gas utility that is so near dissolution that the customers and regulatory bodies will accept anything rather than shut down, the only hope will be to proceed by education. And clearly this education is our job. We can be quite assured that no one is going to do it for us. This can not be put too strongly. It is more than vitally necessary. It may mean the very life of the industry. All gas utilities should sell themselves thoroughly the idea of better rate structures. The larger companies should lead the van.

At the present time the whole trend of our educational work can well be concentrated along just one line, which is to demonstrate that under all present gas rates, the small customer* does not pay his way. The three-part rate, of course,

*The writer of this appendix is quite open-minded as to the value of education and publicity along the line that the "small" customer is not the "destitute" customer. Or, in other words, that under flat rates many prosperous or even wealthy families were unprofitable while many poor families paid more than their cost, actually paying for the loss on the rich customer. This can not be proved to the very last customer, of course, but it is true enough to make very useful stories in the publicity work. If a complete study is impossible, two or three striking examples will be helpful. But keep in mind that in all law and justice this is really no part of our problem. A utility is not an eleemosynary institution and it is charged with the duty of not discriminating between its customers. Assuming for a moment the opposite to the usual condition and that all the large customers were wealthy and all the small customers poor, there would still be no real reason for maintaining a flat rate under which the wealthy would pay too much and the poor too little. The utility would then be in the ridiculous position of agent for the collection of doles from the wealthy to be distributed indiscriminately to the poor. Carrying this hypothetical charitable function to its absurd end, it would then seem to be better for the regulatory body to have the utility install an equitable rate, including an item for charity and turn this fund over to say, the Associated Charities, which would be far better equipped than the utility to administer it!

demonstrates this, but it can be demonstrated equally well with a far simpler study. The following is suggested as one of the simpler methods.

It is now established law that a public utility may earn a reasonable return on the property devoted to public use. An obvious corollary of this law is that each individual in the body public should pay his share of the return on the property devoted to his use. And on this property he should also pay such other charges that essentially and obviously proceed. He should also certainly pay any operating expenses which belong without question to him and to him alone. Let us see how these things can be simply determined.

The property devoted to an individual customer is his meter and meter connection, his service, and the piece of distribution main devoted to him. For convenience, all the customers can be divided into groups, say by meter size, and the average value of this individual property for each customer in the group determined.

In addition to this property, there is the property used jointly to serve all customers. This can be allocated to the customers in one of several reasonable ways. The following are suggested:

1. By capacity of meter.
2. By average connected load.
3. By estimated demand.
4. By estimated diversified demand.

Any one of these is practicable and the final result of the succeeding calculations will not vary materially. The last, that is, the diversified demand, is apparently the best and can be determined in any gas property with reasonable accuracy.

A customer's individual property, as above described, added to his share of the jointly used property, gives the value of the property necessary for his service. On this value proceed certain fixed charges whether any commodity is used or not. These charges are,

1. Return.
2. Taxes.
3. Replacement Reserve.

The total of these three items expressed in percentage taken on the value of the customer's property and added to the cost of meter reading, billing and individual bookkeeping give the costs which, without question or explanation, proceed whether any commodity is used or not.

We need go no further in finding costs to apply to the customer in order to definitely establish the inequity of the vast majority of current rates. The analysis described will show in a well-operated and conservatively valued utility that the average domestic customer should pay somewhere in the neighborhood of $1.15 per month as an irreducible minimum "Customer's Constant Cost"* whether he uses any commodity or not.

Continuing this simple analysis, what would be the cost of the commodity? Always keeping in mind that we are not making a rate but a set-up which the man on the street can understand, the cost of the commodity is obtained by the following simple calculation:

Add the total operating expenses to the return and deduct the total obtained from all the customer costs as above described. Divide the result by the total gas sales and the result will be the cost per M cubic feet.

The result would then be that a simple table can be constructed in parallel with the current gas rate which would clearly

*The term "customer's constant cost" is not the same as the "customer cost" of a three-part rate, as it contains elements of both the demand and customer costs.

show that the customers using the small amounts a month were carried at a loss and this loss can be calculated as a whole and will usually result in a staggering sum.

This sum (and this is a very important part of the educational work) represents the amount contributed by the minority of the customers to pay the loss on the majority.

The thought is that this analysis should be used to educate customers, authorities, and regulatory bodies toward more equitable rates. But it will be equally, if not more useful, in meeting the effort of authorities or others to establish even less equitable rates than now in use. This is so important that too much publicity cannot be given to it. No utility in changing its rate should consider any less equitable structure under any conditions. In the last eighteen months a number of utilities have lowered their base rates. To put such action in plain cold-blooded language simply means that they have arbitrarily increased the contribution which must be made by minority of their customers to pay the loss on the majority. Such action is indefensible on any ground of rate equity, whether it be the act of a regulatory body or the voluntary act of the utility.

Particularly, the so-called service charge should not be changed except to a rate structure that will give the same or greater equity in the share of costs paid by the small customer. The service charge as usually applied is a charge identical with the customer's charge of the three-part rate. It was frequently unpopular. The point is nicely stated in an editorial in the *Engineering News-Record,* July 12, 1923,

"A vast amount of educational work, combined with impartial utility commission administration and whole-hearted cooperation by the utility corporations, will be required in some states before the public will cease to chafe under the service charge."

A service charge is perfectly equitable when properly prepared. The two principal reasons for its coming into dispute are:

First, it has been used for political material.

Second, it was weak in that it was the same amount for all customers.

Obviously, neither of these two reasons impugns the equity of the charge in the slightest degree, but many utilities have been forced to change because of one or the other of these reasons. And some, at least, in changing, have made a retrogressive move to a less equitable rate structure. This, too, is indefensible.

Just one more word about the service charge. It is reasonably probable that if it had borne any other name than the much overworked word "Service," it would have come in for less opprobrium. This suggests even at this late date that changing the name to "customer charge," which it truly is, might save it in some situations.

Other than urging that no utility changes its rate to a less equitable one, it is not proposed to describe any rate structure in this Appendix. However, there is one form which has the approval of some authorities, is simple, and is a good step forward from the unjust flat rate toward a perfectly equitable one. Also, it is a form that can be prepared for by education along the line described. For clearness, figures will be used in the illustration.

For a demand of 150 cu. ft. per hour or less—

For the first 400 cu. ft. per month or less $1.00.

For the next 4,600 cu. ft. per month, 10c per hundred.

For the next 15,000 cu. ft. per month, 9c per hundred.

For the next 80,000 cu. ft. per month, 8c per hundred.

Over 100,000 cu. ft. per month, 7c per hundred.

For a demand over 150 cu. ft. per hour add 3c per month per cu. ft. of demand.

Demand is three-quarters of connected load or may be measured.

Or substitute meter size, connected load, or whatever may be expedient for demand.

Add any stipulations or qualifications necessary in the situation. Particularly qualifications which will stimulate certain classes of industrial business.

Before concluding, there is one other form of education which every utility should always have in mind. The establishment of an optional equitable rate, in parallel with the current rate, would have a self-educating effect that may well be expected to lead to ultimate adoption of the better rate by all customers. The serious drawback to this suggestion is that the new rate would be eagerly accepted by those whose cost would be reduced but it could hardly be expected to be taken up by those whose cost would be increased. And, of course, it is this very class which should be increased. However, the thought should be kept in mind. And one other idea. In taking on brand new territory, *always* use the most equitable rate which can be devised. Because it is a fact that a rate structure with some form of substantial customer charge and a low commodity price will always prove more agreeable to customers in the long run. It is hard to imagine a more potent educational factor:—A little community with a modern rate, and perfectly contented immediately adjacent to a large one with the utility and a substantial minority of the customers fretting under an archaic rate structure.

Customer's Constant Cost and Commodity Cost Estimate

	Group 1	*Group* 2	*Group* 3	*Group* 4	*Group* 5	*Totals*
Size of Meter	5–150	10–375	30–875	60–1500	150–3400	
Diversified Demand—Cu. Ft. per hour	20	143	296	655	1577	
Number of Meters in Active Service	44,693	525	869	85	59	46,231
Value of Meter	7.48	14.34	29.32	79.46	180.57	
Value of Service and Connections, including House Governor	19.20	21.24	21.26	26.82	42.98	
Value of Main	22.70	22.70	22.70	22.70	26.33	
Unit Value Customer's Individual Equipment	49.38	58.28	73.28	128.98	249.88	
Total Value Customer's Individual Equipment	$2,206,679.26	$30,593.95	$63,675.24	$10,962.80	$14,742.58	$2,326,653.81
Total Demand—Cu. Ft.	900,000	75,075	257,224	55,675	93,043	1,381,017
Property value, other than value of customer's individual equipment, allocated by Customer's Demand	48.07	341.56	706.67	1,562.82	3,759.98	
Total Value of Property per Customer	97.45	399.84	779.95	1,691.90	4,009.86	
12.45%	12.13	49.78	97.10	210.63	499.23	
Plus $1.50 for meter reading, etc.	13.63	51.28	98.60	212.13	500.73	
Customer's Constant Cost per Month	1.14	4.27	8.22	17.68	41.73	
Total per Annum	$609,166	$26,922	$85,683	$18,031	$29,543	$769,345

Commodity Cost

Total Cost of Gas Service, Including Return	$1,931,759
Less—Total Customer's Constant Cost	769,345
Commodity Cost	1,162,414
Estimated Gas Sales	1,700,000
Commodity Cost per M	.683

Total Value of Property	$5,622,919.70
Less Total Customer's Individual Property	2,326,653.81
Value of all other Property	*$3,296,265.89

Property Value Allocated by Customer's Demand

Group No.	*Demand*	*Per Cent of Demand*	*Per Cent of Property*	*No. Meters*	*Property Per Meter*
1	900,000	65.17	$2,148,176.48	44,693	48.07
2	75,075	5.44	179,316.86	525	341.56
3	257,224	18.63	614,094.34	869	706.67
4	55,675	4.03	132,839.52	85	1,562.82
5	93,043	6.73	221,838.69	59	3,759.98
Total	1,381,017	100.00	*$3,296,265.89	46,231	

Constant Charges on Property

Taxes	2.63%
Replacement Reserve	1.82%
Return	8.00%
	12.45%

APPENDIX C

COURT AND COMMISSION DECISIONS

F. L. Daily, Chicago, Ill.

The idea that the three-part cost analysis, long since recognized in the electrical field, is equally applicable in the making of gas rates, cannot be considered novel at this time. Over a decade ago, before many of the present commissions were in existence, it was fully discussed by the Wisconsin Railroad Commission in the case of *City of Milwaukee v. Milwaukee Gas Light Company* (1913) 12 Wis. R. C. R. 441. In that case the commission said, on page 476,

"We have in various decisions discussed in detail the nature of the various factors which go to make up the cost of serving the individual consumer. Certain items of cost are almost entirely proportional to the number of consumers receiving service. Others are proportional to the demand which the consumer makes upon the manufacturing plant and distribution system. The remainder for the most part are substantially proportional to the amount consumed. There are, then, three classes of expenses, demand, consumer, and output. Certain items fall clearly into one of these three classes; others, while largely proportional to one of them, are influenced to some extent by others as well.

"It has sometimes been erroneously stated that demand is not a large factor in the determination of equitable gas rates. The argument is advanced that the product is made uniformly throughout the day and not as is required by consumption, as is the case in electric distribution, for example. The holder provides the excess capacity and enables the consumer to take the gas as he requires it. Under such a theory all manufacturing expenses would be chargeable to output. It is well known, however, that there are rather large weekly and seasonal variations in gas sendout. Since it is necessary to provide equipment to meet the annual peak, it is evident that the demand is not negligible in any case. Moreover, the fact that a holder is required immediately necessitates the assignment of investment and expenses of such units to demand.

"When we come to consider the distribution system, it is at once apparent that the demand is a large factor. The sendout at the noon and evening peaks is frequently several times the average sendout of the day. The size of mains and services is determined by the peak demand."

The Commission then discussed at length an apportionment of costs which had been presented in evidence and concluded by authorizing a block rate which in its judgment fairly corresponded to the costs occasioned by the respective classes of consumers.

Progress by other commissions, established thereafter, was far more halting. Minimum bills were permitted here and there, sometimes with little discussion, e. g., *In re Douglas Gas Corporation,* P. U. R. 1915E, 1063 (Ariz.); *Belleville* vs. *St. Clair County Gas and Electric Company,* P. U. R. 1915F, 235, 259 (Illinois).

In New York, the commission (2nd dist.) thought it necessary to argue at length in *LeRoy* vs. *Pavillion Natural Gas*

Company, P. U. R. 1916D, 132, to justify a minimum bill where the company was bound by a flat franchise rate. It said on page 135:

"When the 14th paragraph of the franchise says that 'the company shall furnish natural gas to its customers,' it means that the company will furnish such gas when and as required by such customers, and in addition thereto, it means that the company must stand ready to furnish such gas at all times whether the same is used or not. This is known as readiness to serve, and involves many items of service and expenditure on the part of the company which are rendered and incurred for and on account of the customers, and consists of keeping the distribution system in order, reading meters, answering complaints, correctly keeping a record on its books of the customer's accounts, and in general attending to the convenience and demands of the customers in their utilization of gas upon their premises. The physical use of the gas is merely one phase of the service which the company is called upon to furnish; and the price fixed for the same by the 15th paragraph of the franchise comprehends these other elements and services, besides the actual and physical consumption of gas.

"When, however, gas is not used by a customer in billing quantities, such other elements of service, as distinguished from the actual delivery and consumption of gas, require constant expenditure on the part of the company; and although there is no provision in either of said paragraphs for compensation to the company for such services, there can be no reason why the company should not be paid for the same. The law contemplates that, while the public is entitled to a reasonable service from the company, the latter should have a fair return therefor. This service is not limited to the sale and delivery of gas, but includes all other services on the part of the utility which are rendered for the benefit of the consumers. Apparently this is the basis for the charge which is made by the company to those of its customers who fail to use gas in billing quantities, and which is designated in the tariff schedule filed with the Commission, and also in the note served upon the clerk of the village of LeRoy, as a 'minimum charge'."

And on p. 137.

"It is common knowledge, and has been pointed out before, that each consumer costs a gas company a considerable sum each month for merely keeping his name on the books of the company, reading his meter, traveling to and from his premises for that purpose, and standing ready at all times to answer complaints, make repairs, and furnish gas service; these and other items of actual out-of-pocket expenditures are required of the company, as a public utility, even though the customer consumes and pays for no gas whatever, thus each consumer is a fixed and definite charge upon the company, irrespective of the consumption of gas, and, from a financial standpoint, as well as from an abstract proposition of fairness, it must be said that he should pay his fair share of the actual cost which the company incurs by keeping itself in readiness to supply him with gas.

"These separate expenses incurred for the individual consumers go to make up the total operating expenses of the company, which in turn represent a large part of the entire cost of service; and it is only proper and just, where this expense is ascertained, and is uniform as to all consumers, that the same should be returned, in part at least, to the company. * * *

"In this case, the company desires to provide for a situation where, after installing a gas main in the street and connecting the same with the service on said premises, installing the meter and rendering all the services hereinbefore mentioned, and holding itself in readiness to serve the customer with gas, it finds that the customer uses either no gas at all, or a quantity which yields a net return of less than 50 cents per month, and which does not justify the making and collection of monthly bills. A way should be found, therefore, whereby a reimbursement may be had by the company for the actual expenses incurred in maintaining a readiness to serve that class of customers."

The commission clearly recognized the continuous nature of certain of the expenses of the company, regardless of output. Its attention evidently was not directed to the question of a separate charge for them, except as to months where the output charge would not absorb them.

In *Frankfort* vs. *Utica Gas & E. Co.*, P. U. R. 1917E, 900, the Commission arrived at the same conclusion, allowing a 50c minimum bill despite a franchise ordinance fixing the rate at $1.40 per M. cubic feet. It said:

"Since the creation of this Public Service Commission, it has recognized the propriety of a minimum monthly charge by both electric and gas companies, as evidenced by its decisions and orders in which the same have been authorized. The principle is so well recognized that it is now almost universal in all of the states in which public utilities of this character are regulated by state bodies created for that purpose, the theory being that there are certain fixed expenses which the corporation is obliged to incur for each of its customers, regardless of whether the customer uses any gas or electricity during a particular month and the rates of the corporation are made with a view to providing in some degree for reimbursing it for these necessary expenses."

In re *Ashtabula Gas Company,* P. U. R. 1917D, 790, the Ohio Commission allowed a natural gas company a monthly service charge of 20c, stating in its opinion the considerations which led it to that conclusion. It said on page 801:

"There is much to be said in favor of a minimum or readiness to serve charge, and it has been recognized by the commissions and courts of several states, and experience has shown that it is not the poorer class who usually demand the connection and then fail to use the service, but the well-to-do, who have other means of supply and desire the connection only that they may be prepared for emergencies.

"There is a certain amount which the public must pay to enable the utility to operate. If a portion of it is paid in a readiness to serve charge, that much less is necessary to be produced from the sale of gas. The readiness to serve charge does not yield the company any greater sum, nor cost the consumer any more money. It results only in a different distribution of the burden. It would seem that anyone demanding the service should pay at least a sum equal to a fair rate of interest on the 'bare bones' of the investment, whether he uses any gas or not, and especially is this true as to Ashtabula, where the testimony discloses that out of 5,149 consumers, only about four or five hundred use gas for heating purposes throughout the year."

In the well-known *Ben Avon Borough* decision, P. U. R. 1917C, (relating to water rates) the Pennsylvania Commission went a step further by allowing a graduated service charge, the probable demand being gauged by the size of the service pipe. The opinion has considerable bearing upon the application of similar principles to gas rates, in that water, like gas, can be stored, and the usual arguments against applying the three-part cost analysis to gas rates would in large part apply equally in the case of water rates. The Commission said on page 421:

"We are of opinion that it is more just and equitable to make what is termed a ready-to-serve charge in the place of a so-called 'minimum' charge. The ready-to-serve charge is justified on the ground that the utility, after its plant is once constructed and ready for service, may ask each patron to pay a reasonable amount based upon the size of its service pipe, in order to reimburse the utility for the cost of so much of its plant as is required to enable it to at all times stand ready to serve its patrons.

"We have set forth in the schedule which we have prepared the amount of ready-to-serve charges to be paid by its patrons classified on the basis of the size of the service pipe. These charges, we think, will protect the company in its service, and at the same time will not impose any unnecessary burden upon its patrons."

In the *Pekin Water Works* case, P. U. R. 1917C, 838 (also a water rate case), the Illinois Commission took the same view, fixing a graduated consumption charge and a separate service charge varying with the size of the service pipe. It said on page 856:

"In the rates determined hereinafter, the Commission is establishing a basic service charge, supplemented by a consumption charge. These two charges constitute a rate which is closely in accord with a theoretical rate structure and which conforms more closely to the actual cost of water service in the city of Pekin. For example, there exist certain fixed operating costs which are chargeable against an individual consumer, regardless of the quantity of water used: and these average charges vary somewhat with the size of the consumer's service and meter. Fixed charges, such as interest and depreciation upon the investment in meter, meter box, stop cock, service pipe, and other consumer equipment, are directly assessable against the consumers; as are also certain operating costs, such as maintenance and repairs to meters, and to services and the reading of meters, with billing, bookkeeping and collection costs. Other costs, such as fuel, oil, station supplies, station labor, distribution labor, etc., are directly assessable in a large proportion to the actual water used by the various consumers, as determined by meter readings. Likewise, certain fixed charges, such as interest and depreciation on plant equipment and distribution system, are largely assessable against capacity. In a straight rate, all these charges are lumped together and averaged; while, in a block rate, an effort is made to distribute the consumer charge and the capacity charge either among the various blocks or in minimum bills. In a maximum demand form of rates, the advocates of the same purport to apportion and distribute the capacity charge to the consumers in proportion to the individual's usage of the utility's plant. From a theoretical point of view this allocation of costs is accomplished by a maximum demand form of rates; but practically there are few maximum demand rates which contemplate actual measuring of the individual's demand, and therefore become cumbersome and unwieldy applications of a theory which of itself is none too scientific and defendable. Although it may be generally impracticable to establish theoretical rates particularly to the average small-water consumer, it is quite practical to approximate the theoretical rates by the establishing of a sliding-scale block rate superimposed upon a service charge; and this form of rates the Commission has determined upon herein. Average variations in the costs of rendering service to large and to small consumers are taken care of by varying the service charges proportionately to the size of meters and by diminishing the consumption charge with large and long-hour usage. The service charges fixed hereinafter will constitute the minimum monthly or quarterly bills; and these minima are reductions over the respondent's present rate which inherently contains a charge for the average quantity of water consumed under the minimum quantity."

In *Re Los Angeles Gas & E. Corp.*, P. U. R. 1917F, 717, the California Railroad Commission contented itself with allowing a minimum bill. Its language, which was pointed enough, would have justified a more far-reaching result:

"The evidence in this case discloses some remarkable situations with relation to apartment-house gas service, which indicate that under the present system of no minimum, gross injustice and inequality has resulted. There are approximately 2,400 meters in apartment houses from which no revenue is obtained. On 50 per cent of the services in apartment houses the monthly gas bills have been less than 30 cents per meter. The aver-

age monthly bills from all apartment-house meters is less than 60 cents.

"As to these apartment houses, the company must stand ready at all times to serve gas to whatever extent is demanded, yet with no assurance that an amount of gas will be used, charges for which will even measurably pay for the cost of service. Of course the inevitable result of this is unjustly to burden the other consumers who take gas regularly in sufficient quantities to provide adequate compensation for the service.

"I cannot see why service in an apartment house should not be burdened with a reasonable minimum charge precisely as the service to small cottages should be so burdened. It is not true to say that the apartment is vacant and rented intermittently, and that it would be inequitable to apply a minimum; the cottage is subject to vacancy in tenancy the same as the apartment.

"The minimum charge for gas service is now almost universally applied; and careful investigation and long consideration have convinced this Commission that in a condition such as we find in Los Angeles, a sound schedule of rates must include a minimum charge."

Though the matter involved was water rates, the language could be applied with little modification to the case of a gas company.

In *Re New Jersey Gas Co.,* P. U. R. 1918B, 438, the New Jersey commission permitted a separate service charge sliding with the size of the meter and based on the cost of maintaining that part of the company's property which was on the average customer's premises. It said, p. 445:

"In a recent report of the Board in the matter of the application of the New Jersey Northern Gas Company in re rates will be found a discussion of the nature of this charge. In brief, as used in that report, it was the monthly or annual cost to the company for the interest, depreciation, and repairs to the company's property on the customer's premises and devoted to his individual use."

The contemporaneous action of the Idaho commission in *Re Pacific Power & L. Co.,* P. U. R. 1918D, 665, in allowing a minimum bill but refusing a service charge, is illustrative of the motives to be reckoned with. It said, p. 670:

"The Commission does not look with favor on the service charge proposed. It believes the cost of service can be equitably distributed by means of a proper minimum charge which will meet less opposition from the consumers than the service charge."

In *Re City Light & T. Co.,* P. U. R. 1918F, 938, on the other hand, the Missouri commission turned from the principle of a minimum bill to that of a separate service charge, saying:

"In fixing the form of rate schedule, we have approved the company's suggestion of a service charge in lieu of the more common minimum charge. We believe that it is the more equitable in that it more nearly assigns to each consumer the costs actually incurred by that consumer. If a consumer is living in a house adjacent to a street containing a gas main, he costs the company nothing until he becomes a consumer. As soon, however, as he elects to use the gas, the company is put to an additional expense, regardless of whether the consumer uses any gas. A meter is installed. It is read every month, the bills are made out, collections are made, the meter and service pipe are kept in repair, in addition to the interest and depreciation on these items. There are also some gratuitous services and inspections for which no charges are made. While we have not computed the exact costs of this personal service in this case, the items are well known generally, and have been estimated by the company at 50 cents per meter. This is not excessive.

"The minimum charge is more general and perhaps better understood at the present time. It is more discriminatory,

since each customer may use gas to the value of 50 cents, and be charged only that amount in the monthly bill, whereas he has not only used 50 cents worth of gas, but he has incurred customer costs, which we might call personal costs, to the amount of another 50 cents. This is unfair to other consumers who must make up the other costs.

"Objections to the service charge are usually based on a misunderstanding as to the purpose thereof. Consumers will argue that no other line of business attempts to maintain such a charge. In other lines of business this charge is not practical, and is not applied for that reason. The fundamental fact is that in other lines a merchant can refuse to deal with an unprofitable customer or make up the loss from other sales. Public utilities, however, must treat all alike. They must furnish service to all persons who will comply with reasonable rules; and in order that some consumers may not be burdened with the costs incurred by the more unprofitable, these unprofitable consumers should at least pay the expenses actually incurred in serving them. The service charge approaches this much more nearly than the minimum charge."

In *San Francisco* v. *Spring Valley Water Co.,* P. U. R. 1919A, 427 (a water case), the California commission took the same step, saying:

"We have given this matter very extensive and careful consideration, and have arrived at the conclusion that the sound basis for establishing these rates is that there should be first a service charge based on the size of meter, which service charge is to be paid by all consumers regardless of the amount of water used.

"This in distinction to the establishment of a minimum charge which involves the payment of a fixed sum by each consumer based on the size of the meter used, and which sum includes a service charge, together with a charge for a given quantity of water whether used or not. The minimum charge is invariably higher than the service charge, and it involves the payment by each consumer for a fixed amount of water, regardless of whether or not he uses it. There is no answer known to us which can be made to the man who complains that under a minimum rate he is compelled to pay the same amount for 100 cubic feet of water as his neighbor pays for three or four hundred cubic feet of water, depending on the amount fixed for minimum use.

"On the other hand, the establishment of a service charge is designed to exact from each consumer the cost to the company of standing ready to serve and thereafter to pay for only such water as he may use.

"We believe that, under the conditions of service we are dealing with herein, the service charge once established and thoroughly understood will be agreed to as the fairest and most equitable method of fixing rates."

In *Light Committee* v. *Penn Central Light & P. Co.,* P. U. R. 1919B, 882, the Pennsylvania commission, which had already approved the principle of a separate service charge, took the further step of holding that a flat service charge, equal for all consumers, was discriminatory, in that it failed to allow for variations in demand. The commission said:

"The ready to serve charge is the same for all customers, regardless of the size of the meter. No testimony was offered in support of this feature of the new schedule, and, in our opinion, it is not reasonable and should be changed. The ready to serve charge should vary in recognition of the variation in demand as evidenced by the size of the meter, and a graded schedule should be prepared that will return practically the same revenue that would be received from a uniform ready to serve charge of 75 cents per month. * * * There is no distinction in principle between a system of minimum payments and a system of ready to serve charges. Both are predicated upon the same analysis of the total cost of the service. Both recognize the element of 'stand ready to serve.' In a schedule with

minimum payment requirements, the ready to serve costs are concealed in the rate per unit and in the minimum. In a schedule with a pure ready to serve charge these costs stand revealed. * * * The Commission has not adopted any fixed policy in the matter of a ready to serve charge, even though it has in several instances, under certain conditions and circumstances, approved its use. A ready to serve schedule can be made to follow more closely the cost of the service, and hence results in a more equitable division."

In *Re Utah Gas & C. Co.*, P. U. R. 1919D, 645, the Utah commission allowed a uniform service charge of 25c, relying on the reasoning of the Missouri commission in an earlier case. It said, p. 665:

"It will be observed that the Missouri Commission, in the case mentioned above, approved a 'ready to serve' charge of 50 cents per meter. The applicant in this case asks only for a 25-cent charge, which amounts to $3 per year, on each meter in service. Inasmuch as this charge must cover interest and depreciation on the amount invested by the company for individual user, in addition to the company's investment in plant and mains, and that it must cover also the various items of expense mentioned by the Missouri Commission in the quotation hereinbefore given, which includes reading of the meters, issuing bills, making collections, maintaining the meter and service pipe in repair, etc., we are inclined to think the consumer will recognize the charge as not excessive."

In *Sellersville* v. *Highland Gas Co.*, P. U. R. 1920A, 321, the Pennsylvania commission pointed out the distinction between output costs and other costs. Though it did not indicate a further division of the latter into demand and consumer costs, its language is pertinent. It said, p. 323.

"It is a popular error to say, that a 'readiness-to-serve' charge requires consumers to pay for that which they do not receive. This is a wholly fallacious conception. Such charges are based upon the fact that the plant must be kept in a condition to render immediate service to each of its patrons whether he draws upon it or not. It costs the company money to be ready at all times to render such service. For a supply of gas must be kept in the mains and pipes to the consumer's business ready for his immediate and instant use when he desires it, and notwithstanding he may not light it at all. In some respects it is comparable to the telephone which a patron has installed in house or office, ready to transmit messages whether it is actually used by the patrons or not, and also to the charge for a taxicab or automobile which a patron may hold awaiting his use while on visits to store, house, or office. If such charges are not imposed upon the rate payers in the form of a ready-to-serve charge, they must of necessity appear in some other form, for the gross amount, which any company is permitted to obtain from its patrons, is made up of two elements of service actually rendered them, 'readiness-to-serve' and 'consumption.' If the readiness-to-serve charge is lowered, the consumption charge must be raised, and if the readiness to serve is eliminated as a separate item, then it will be necessary to include this cost in some other form.

"Readiness-to-serve includes those items of expense of keeping the gas or water in the pipes ready to be used, and the consumption charge begins where this readiness-to-serve expense ends, and the two together make up the proper charge to the consumer, whether presented in one figure or separated into two elements."

In *Holland v. McGuire,* P. U. R. 1920B, 149, the Michigan commission sustained a minimum monthly bill as necessary to cover "fixed expenses," saying:

"The principle of a 'minimum monthly charge' in the case of public utilities, has long been recognized and applied. This charge is made on the theory that there are certain fixed expenses which the util-

ity is obliged to incur for each of its customers, regardless of whether the customer makes use of the service during the particular month or not. The company, under this method, is providing for a return on its investment made for the customer, even if no consumption of gas is recorded. A minimum charge, of course, implies that said charge will be absorbed in the rate in the event the monthly bill for gas amounts to at least the specified minimum. We feel that the Holland Gas Works should be entitled to a monthly minimum charge of 50 cents."

In *Schaub* v. *Mechanicsburg Gas & W. Co.,* P. U. R. 1920B, 258, the Pennsylvania commission approved a flat service charge of 30c per month, though conceding that in theory the uniform charge was in effect discriminatory. It said, p. 261:

"In the absence of detailed data in the record, the cost incurred by the company to install service and hold itself in readiness to furnish gas whenever demanded cannot be computed in this instance. But it has been repeatedly disclosed that where a strict analysis of the cost of installing service has been made by a gas company having over 700 patrons, a ready-to-serve charge of 30 cents per month would fall materially below what was actually expended for that purpose. There is nothing in the record, nor in the experience of the commission, that would warrant the conclusion that the present service charge of 30 cents per month is unreasonable or excessive. * * *

"The further objection of complainant that a uniform charge for all sizes of meters shows discrimination is sound in theory. But on the prosaic level of business, actual conditions must always be given due consideration. In the present instance, the number of patrons using the larger capacity meter is so small that a recognition of this principle would not materially affect the monthly payment of a great majority of the consumers."

In *Re Fulton Fuel & L. Co.,* P. U. R. 1920E, 119, the New York commission (2nd dist.) allowed a flat service charge and at the same time eliminated from the company's schedule a provision for a minimum bill. It said, p. 122:

"The company in its proposed schedule of rates includes both a service charge of 25 cents per month per meter, and a minimum charge of $1 per month per meter, the latter charge being absorbed if the monthly consumption charge equals or exceeds it. These two charges are intended for the same purpose, namely, to reimburse the company for costs incurred regardless of whether the consumer uses any gas or not. Therefore, both charges should not appear on the same schedule and one should be eliminated. In the present case, the revenue derived solely from this minimum charge would be unquestionably very small as with gas at $2.40 net per 1,000 cubic feet and a minimum charge of $1 per month, it would only require a consumption of slightly more than 400 cubic feet per month before the charge would be absorbed. No evidence was submitted to show what the revenue due solely to minimum charge would be under the proposed rates. The minimum charge will, therefore, be disallowed, and the company allowed to increase its service charge 10 cents per month per meter to compensate for loss of revenue due to the elimination of the minimum charge. As there are approximately 1561 meters in service, this would provide an increase in revenue amounting to $156.10 per month."

In *Town Board* v. *St. Lawrence Transmission Co.,* P. U. R. 1920F, 214, the New York commission (2nd dist.) observed:

"A minimum charge may be defined as a charge which, if properly computed, is made up of a service charge plus a sum sufficient to pay for the average quantity of electricity used by the consumers affected. A service charge, or as it is sometimes called, consumer cost, is the expense incurred by a company in being ready to give service irrespective of what a consumer uses. * * *

"A service charge is fairer and more equitable than a minimum charge because under the minimum charge the less current a consumer uses the more he pays for having the privilege of using the service whenever he requires it. Under a service charge the cost of having the service available for use is borne equally by all consumers and not entirely by the small consumers as is the result in a minimum charge."

In *Hartford* v. *Hartford City Gas L. Co.*, P. U. R. 1920F, 840, the Connecticut commission, discussing the same question, said, p. 841:

"A customer or readiness-to-serve charge is a form of minimum charge made to cover the costs incurred by the utility in holding itself in constant readiness to render service, whether or not any units of service are actually delivered. A customer or readiness-to-serve charge differs from the strict minimum charge to the extent that a customer charge is made for service rendered, not including units of service sold, and a minimum charge is a combination charge for service rendered and a limited number of units sold.

"If the small consumer is not, in fact, paying the actual cost of service, then the balance of that cost plus the cost of his actual consumption of gas is being paid for by the large consumer.

"A reasonably low rate for the average or small consumer of gas must of necessity depend upon the number, extent, and development of the large consumers, and any policy which tends to retard or restrict the large consumption will be reflected in increased rates to the small or average consumer."

In *Re Sea Cliff & Glen Cove Gas Co.*, P. U. R. 1921A, 211, the New York commission (2nd dist.), following its previous reasoning, said, p. 216:

"The petition and the practice of this company suggests a minimum charge per month. A service charge seems to be much fairer. Those expenditures which are necessarily required, irrespective of the amount of consumption by the individual consumer, should properly be borne by all the consumers irrespective of the amount of consumption. Where a minimum charge is fixed which contains to some extent a charge for consumption and for the balance of the charge a compensation for certain charges benefiting all consumers, the load of the latter charges falls entirely upon the smaller consumers. The difference which he pays between the charge for the gas actually consumed and the minimum charge, he pays for the charges in question, and the less he pays for gas the more he pays for those other charges. The burden, therefore, falls entirely upon the small consumers and in the same proportion as the consumption decreases the burden of carrying those other charges devolves upon them. It was, therefore, suggested by the sitting commissioner on the hearing that instead of a minimum charge a service charge should be substituted, and this met with the approval both of the company and the municipality."

In *Re Rochester Gas & El. Corp.*, P. U. R. 1921A, 415, the same commission said, p. 418:

"The service charge as the term is herein used is a uniform charge to all consumers, which together with another charge based upon the amount of gas consumed constitutes the entire rate to be paid. The service charge is not new although it has not as yet come into general use. It is sometimes called a readiness to serve charge and sometimes a consumer's charge. Its real nature does not seem to be generally understood by consumers, and unless it is understood it appears to them to be a mere arbitrary imposition in addition to the regular price also paid for what they consider the service supplied. It differs from the familiar minimum charge in that it is imposed on every consumer regardless of the quantity of gas used, while the minimum charge is practically imposed only upon those consumers using less than a certain quantity of gas, and becomes absorbed in the

meter or commodity rate as soon as that quantity is reached. It was intended to serve the same purpose as the service charge but only did so to a limited extent and in a very crude manner. Its advent was greeted by an enormous storm of disapproval on the part of consumers. Its injustice was vehemently asserted, and because of its partial and discriminating effect the attack was not without foundation. It has sufficient reason behind it to enable it to resist the attack. It is now all but universal where the service charge is not applied, and it is an interesting fact that those who now resist the service charge are strenuous advocates of the minimum charge; some of them, probably, merely because they are accustomed to it; others for reasons worked out as applied to their own bills by means of a lead pencil and a pad of paper. * * *

"A moment's consideration must convince anyone that every gas company is subject to a very considerable expense in the case of a person whose premises are connected with the company's mains, who has a meter installed, the valve open, and who uses no gas whatsoever. Suppose in any community that no patrons should, in fact, use gas for a period of one month. The plant of the company is there and yielding no return. It must, to a certain extent, operate in order that anyone may have gas if he tries to use it. In fact, the expense of the company would be substantially as in normal times except for the actual cost of producing the gas that would ordinarily be consumed during that period. To a degree this applies to the case of a single consumer who is, as the phrase goes, 'connected up,' but who does not use gas for any particular period, as, for example, if his house be closed during a summer vacation. All expenses can now be ascertained through the accounts of the companies required to be kept according to a uniform system prescribed by the commission largely for this purpose. In this way costs can be analyzed, and when so analyzed, it is found that certain thereof vary directly and proportionately with the number of consumers, that is to say, the cost to the corporation of standing ready to serve is exactly the same whether the consumer and his family be away on vacation with the house closed or whether he be a large industrial consumer using many thousand feet a day. In addition to these items there are others where undoubtedly a great part of the total is likewise proportioned to the number of consumers and has no relation to the amount of gas consumed. In fact, the only item of expense, clearly and unquestionably dependent upon the amount of gas consumed and not in any degree upon the number of consumers, is the cost of producing the gas and storing it in the holder. * * *

"The corporation provides and installs meters and it bears the expense of the pipe from the main to the property line. Here is an investment upon which it is entitled to a return and which is not constant whether gas is used or not used. Meters must be inspected and kept in repair and so must the service pipes. Meters must be read whether gas is used or not, accounts must be kept with the individual consumer and bills must be rendered and accounts collected. While the rendition and collection of bills is not regardless of whether any gas is consumed, the expense in nowise relates to the amount of the consumption, and it is, therefore, a charge which should be distributed among the customers as a total. Meters and services depreciate regardless of the consumption and the total depreciation depends upon the number of meters and number of services. The size and extent of mains is largely related to the number of consumers, and theoretically, therefore, some proportion of the return of this investment and some proportion of the cost of maintenance and of depreciation should go into the service charge; but, these items have also a direct relation to the amount of gas produced and used and in the absence of any satisfactory basis of apportionment it is better to refer them entirely to the commodity cost. The same is true of taxes. We might extend the inquiry to other less important items but enough has been said to illustrate the principle. * * *

"From what has already been said it must be clear that a straight commodity rate is inequitable, and if permitted at all,

should be permitted only under exceptional conditions where the inequity resulting is inconsiderable. The static cost, above referred to, cannot, of course, be distributed with absolute justice and equity among all. The man, who uses no gas but is connected up, is not in precisely the same situation as a man who uses one hundred feet a month, and neither is the situation of a man who uses one hundred thousand feet a month. A general basis must be found which will result in a minimum of inequality. The question, therefore, resolves itself into a consideration as to which of the two remaining rates is preferable: the minimum charge or the service charge. The expense to be paid being in great part exactly, and in the rest almost exactly, proportioned to the number of consumers, the service charge, made the same for each consumer, is indicated strongly as the proper rate. The indication is so strong that it may well be taken as controlling unless its opponents can, in some way, demonstrate the superiority of the minimum charge."

The only adverse comment to which the commission's language is susceptible is that the commission evidently arrives at the conclusion that the service charge should be uniform for all consumers, i.e., it overlooks, or declines to recognize, a demand element in the costs.

In *Re Kingston Gas & El. Co.*, P. U. R. 1921B, 76, the same commission in again approving a service charge, illustrated the general principle by a striking simile. It said, p. 85:

"The position of the customers of a gas plant is somewhat similar to that of the members of a social club. In order to connect you with the plant, and to maintain the equipment and organization necessary to render service, a certain investment is expended, and it is necessary whether or not any gas is consumed. So, also, the plant maintained by a club requires certain expenditures irrespective of materials furnished its members. To meet this cost of overhead, which is always present irrespective of use, annual dues are collected, and in addition members are charged for the actual materials consumed."

The case of *In Re Joplin Gas Co.*, P. U. R. 1921B, 676, is somewhat notable in that the Missouri Commission was there presented with a specific request for a three-part rate. The published report does not indicate the disposition of the case but the statement of the Commission shows the form of rate which was requested:

"The so-called 3-part rate represents an effort to assess charges for gas service so that each customer shall pay an amount directly proportional to the investment required for his particular service plus his proportional amount of the operating expenses based on the quantity of gas used. The first part of the rate, for which the gas company desires $1 per month, represents the cost of reading meter, billing, collecting, bookkeeping and such expenses as are alike for each consumer independent of his demand or consumption. The second part, or the demand charge, for which the gas company desires 32 cents per cubic foot of maximum hourly demand, represents the return on the investment required, plus the depreciation reserve, plus taxes, divided by the total maximum demand. The third part, for which the gas company desires 35 cents per 1,000 cubic foot of gas sold, represents the amount of the operating expenses, including all labor and material divided by the total amount of gas sold. This is a very similar form of rate to the rate which has for many years past been in effect for the sale of electric current, where a customer's charge and a primary demand charge are almost universally adopted, generally in a combined form, at least by the larger utilities. Water companies likewise have a demand charge based upon the size of meter required."

In *Re Lansing Fuel & Gas Co.*, P. U. R. 1921C, 465, the Michigan commission separated consumer costs from output

costs and fixed a flat service charge of 45c to cover the former for domestic consumers. For industrial consumers it made the service charge slide with the meter capacity, thus tacitly recognizing the demand element as well. It said, p. 482-3:

"Having determined the average rate which the company must receive for all of the gas which it sells, it now becomes necessary that we attempt a more equitable allocation of certain of those costs included in the average rate which are primarily controlled by the number of meters, rather than by the amount of gas used. It will be apparent that it costs no more to read the meter, make out the bill, and collect the amount due for a consumer who uses 100,000 cubic feet of gas per month than for the one who uses 1,000 cubic feet of gas per month. It will further be apparent that other things being equal, a certain proportion of the fixed charges when based upon the number of meters, rather than the amount of gas consumed through the meters, is more equitable than when this cost is loaded entirely upon the unit of consumption; in other words, it costs the gas company equally as much for interest charges upon the investment tied up in customers' installations and meters when the same are of like size, whether the customer uses 400 cubic feet per month or 10,000 cubic feet per month.

"It is our belief that a proper schedule of rates is one that approximately secures from each class of service the cost of rendering service to that class."

The holding of the same commission in *Re City of Grand Haven,* P. U. R. 1921D, 318, 328-9, was substantially identical.

In *Glove Workers' Union* v. *Fulton County Gas & El. Co.,* P. U. R. 1921C, 789, the New York commission, pursuing the old fallacy that because gas can be economically stored up to a certain point there is no such thing as a demand element in the costs, rejected a "demand" charge, while allowing a "consumer" one. It said, p. 793:

"The tariff complained against contains a service charge as a sliding scale increasing in proportion to the capacity of the meters. There is here interwoven with the ordinary service charge, as we have come to know it, a feature which is sought to be justified on the theory that there is included with it something of the nature of the so-called 'demand charge.' That is, a customer is required to pay besides the rate based upon the general cost of the service, and in addition to the amount charged for the gas actually consumed, an additional charge for the demand which the company must be prepared at all times to supply to it.

"Our attention has been called to the brief of the company to a combined charge of this nature recommended by the National Bureau of Standards. We fail to see, however, the propriety of injecting this foreign element into the computation and establishment of a service charge.

"The factor of demand, of course, in the consideration of electric cases, is often times important, because the producing company must be ready to furnish at all times the maximum amount which the consumer may require, and for that readiness is entitled to be recompensed. In the manufacture and distribution of gas, however, the situation is materially different. Unlike electricity, which can only be used at the moment of production, gas can be stored in substantial quantities, and thus the drain of the peak load upon the manufacturing plant materially lessened and the inequality of production diminished.

"But even though it may be proper in some instances to impose a demand charge, it should not be mixed in with the service charge. It is more nearly related to the consumption charge, based upon the actual amount of gas used, and if not to be segregated by itself would more properly be absorbed in that factor. For this reason, the service charge as

stated in the tariff should be disallowed and such charge should be fixed at a flat equal rate of 40 cents per month to each customer."

The Connecticut commission in *Danbury* v. *Danbury & Bethel Gas & E. L. Co.*, P. U. R. 1921D, 193, was fully advised of the theoretical structure of a 3-part rate but shrank from the task of attempting to apply it, except for industrial consumers, allowing for ordinary consumers a flat service charge. The commisssion said, p. 208-9:

"In the recent Hartford and Meriden cases this Commission held that a service charge, as such, is an equitable element of a rate structure, and is so recognized and being established by practically every rate-making tribunal in the country.

"There is no uniform practice, however, of determining the particular elements or expenses to be considered in arriving at a proper service charge, and there are but few cases where the service charge as adopted has been in strict conformity with the amount calculated upon any recognized formula. The service charge installed by companies in other states and approved by the commission has usually been an arbitrary amount, less than the amount calculated as the actual service charge.

"In some cases a graduated service charge has been installed, in accordance with the size of the meter, but owing to the comparatively small number of large meters, the maximum or high service charge has but a minor influence upon the total revenues received from such a charge.

"Rate experts favoring a service charge for gas companies do not maintain that the maximum amount figured as a service charge upon all the elements and allocations of expenses pertaining to such a charge, should be adopted, but a lesser, arbitrary amount, which will tend more equitably to distribute the permanent fixed and necessary 'readiness to serve charge' among all the patrons. To make a scientific equitable distribution of the total service charge would necessitate an analysis of each individual customer or meter service, the magnitude of which makes the proposition prohibitive.

"The so-called service charge consists of two general elements—a demand charge, which varies in accordance with the actual demand or size of the meter, and a customer charge, which remains constant and applies equally to each meter.

"In a typical case considered by the National Bureau of Standards in its recent report to the Congress, upholding the principle of a service charge, the sum of 30 cents per meter per month was found to be the consumer charge, for the Washington Gas Light Company in the District of Columbia, while the demand charge ranged from a minimum of 25 cents per meter per month to a maximum of $10.70 per meter per month. Where a block or step rate commodity charge and a differential between domestic and industrial use are adopted in a rate schedule, such a step rate and differential, to a certain extent, take the place of the service charge, particularly the demand charge, and thereby reduce the actual or calculated service charge.

"The installation of a small service charge would aid in meeting the most important and universally applicable expenses of the company in maintaining its readiness to serve position, without imposing upon the small consumer the major part of the burden, This policy seems to have been adopted in a large number of cases where the service charge approved by commissions has been an amount materially less than the actually calculated charge.

"Considering the impracticability of making any absolutely scientific distribution of such charge, and the existence of a differential between domestic and commercial use, and at the same time recognizing the general benefit and fairness of distributing at least a portion of the service charge, which, under any condition, would be applicable to each meter, among all patrons, the commission is of opinion

that a lesser but arbitrary amount, representing a fixed portion of the total service charge, should be established and distributed equally among the meter users.

"The commission in this case will approve a service charge of 35 cents per meter per month for domestic service and allow the demand and customer charge as established by the company for industrial use to remain."

The New Jersey commission has in recent cases yielded to popular objection to a service charge, even though realizing that that objection is based upon a misapprehension as to its theory and purpose and has, accordingly, refused to authorize such a charge, seeking to compensate the companies by allowing block rates instead. Thus, in *Re New Jersey Gas Co.,* P. U. R. 1921D, 357, the commission said, at p. 367-8:

"The schedule of rates now in effect, as hereinabove recited, provides for the collection of a fixed monthly service charge varying with the size of the meter, plus approximately $1.91 for domestic customers and for the gas actually used of $1.65 per thousand for wholesale or industrial gas. Considerable objection was expressed at the hearing before the Board against including a fixed service charge owing to the fact that many consumers claim that service was not rendered by the company on many occasions. While the theory of the derivation of the service charge does not relate to the service of gas actually rendered by the company, but is related entirely to the interest, taxes, maintenance, and depreciation on the service pipe and meter devoted to the individual customer (and which does not benefit any other customer) nevertheless, owing to the popular objection to this form of charge, the Board will calculate a schedule of block rates omitting therefrom a fixed service charge."

In *Re Cape May Illuminating Company,* P. U. R. 1921D, 695, the same commission followed the above decision, and rejected a service charge, admittedly for the same reason.

In *Customers v. Cohoes Power & Light Corp.,* P. U. R. 1921D, 421, 445, the New York commission (2nd dist.) following its earlier decision in the *Fulton County Gas & El. Co.* case, disallowed a graduated service charge and fixed a flat one instead.

The Rhode Island commission in *City Council v. Providence Gas Co.,* P. U. R. 1921D, 842, in permitting the company to put in effect a uniform 50c service charge, quoted in support of its action the testimony of Mr. Frederick C. Freeman as follows:

"It may be said at the outset that the 50 cents per month so-called service charge is but an arbitrary rate. The cost of service to consumers using less than an average of 3 M c.f. per month will be more than the above rate will produce, but it is recognized that the form of rates is a step in the right direction with the hope that ultimately a more equitable rate may be established, in which the service charge will be higher and the price for gas used less.

"It is to be expected that those consumers who have been paying far less than they should will protest against a service charge rate. They have been paying less than they should ever since the gas industry was established. It is a fair statement that not one of them realizes that this is so. So it is no wonder that they will complain when they are requested to pay a little more toward their fair share of costs. Policy and equity are opposed, but eventually if the gas industry is to survive there must be but one result, and that is,—Rates without Discrimination —Fair to All.

"The future growth of the gas industry probably lies in the industrial field. If this class of gas business is forced to carry the cost burden for the small do-

mestic consumer, the gas industry cannot hope to compete with electricity and with other fuels. It is a self-evident fact that the electric industry does not burden the large user for the benefit of the small one. Witness the range in its rates.

"The ideal rate is one where all would pay alike for gas used, irrespective of quantity, whether one foot or a million. This rate would be made up of two factors, first the cost of gas in the holder, second a service charge, made up in small part of a consumer charge, but largely of a demand for gas charge. In the case of Providence, based on an average yearly demand, this service charge would run from $17.40 per year per consumer for the smallest user to $15,912 per year in the case of the largest consumer.

"Such a type of rate readily lends itself to an automatic change according to change of material and labor costs. The service charge part of the rate is not subjected to violent fluctuations, but the holder cost in such times as we are now passing through is more or less subjected to fluctuation. A rate based in part on holder cost of gas, and in part of service charge could be varied periodically, say every three or four or six months to suit the actual holder cost obtained. Such variation in rate would be similar to that of the coal clause in the electric rates."

The commission added,

"The Commission is convinced that the minimum application of the service charge principle which is made by the company in the schedule of rates under consideration is reasonable."

On appeal to the Supreme Court of Rhode Island the decision of the commission was sustained. *Rivelli* v. *Providence Gas Co.,* 115 Atl. 461, P. U. R. 1922B, 548. The court said:

"It would be possible to increase the rates for furnishing gas used so as to cover the service charge. When the consumer uses such a small quantity of gas that the profit upon it will not defray the costs of serving him with it, it is not unreasonable that he should be required to pay for such service in addition to paying for the gas used by him. * * *

"The claim that the schedule of rates is unjustly discriminatory is based upon the claim that the service charge is illegal and places an unjust burden upon the so-called 'small consumer.' Inasmuch as we have held that the service charge is legal and applies to all consumers alike, it cannot be held to be unjustly discriminatory."

The Maryland commission in *Mayor, etc.* v. *Hyattsville G. & E. Co.,* P. U. R. 1921E, 240, approved the principle of a separate service charge, quoting at length from the *Rochester Gas & El. Corp.* case *supra,* adding,

"The United States Bureau of Standards in its report to Congress on December 6th, 1920, upon the quality and cost of production and distribution of gas in the District of Columbia, approved the service charge and suggests charges ranging upward from 55 cents per meter per month for the Washington companies. The justness of the service charge is now generally recognized and conceded, and this form of charge is constantly being adopted in the various states. It is in common use throughout the country in connection with charges for electricity, and is becoming more and more generally used by gas and water companies, with the consent and approval of the various state regulatory bodies."

The Michigan commission in *Re City of Sault Ste. Marie,* P. U. R. 1921E, 321, approved a flat service charge of 25c a meter for all consumers. Its language is helpful. It said,

"There are certain fixed charges common to all users. When a customer asks the company to furnish gas, the company is obliged to spend a certain amount before it can render service, in the way of constructing a pipe line to the premises and the purchase and installation of a meter. This expense is incurred by the

company for the applicant alone: such expenditure does not benefit any other customer in any way. After the connection is made and the applicant gets gas, it becomes necessary for the company each month to read the meter, report the same to the office, have same entered upon the books of the company, bills made out and the money collected. It will, therefore, be seen that the expense of installing the service, of reading the meter and keeping it in repair, entering the charges upon the books of the company, billing the user and collecting the same, are all made for the benefit of the user alone. If each customer should pay to the company the actual expense he causes the company, and all pay the same price for gas, we would have an ideal condition. Where the cost of installation is the same, the cost to the company in keeping the meter in repair, reading it monthly, making necessary book entries, billing, and collecting the amount due, is the same whether the user uses 10,000 cubic feet per month, or 100 cubic feet per month. A readiness-to-serve charge has been adopted by a majority of the states, and we believe it comes nearer to doing exact justice, than a flat rate.

"People who are not accustomed to it are likely to feel that the service charge added to the rate per thousand is the rate per thousand they are being charged. The average consumption of gas in Sault Ste. Marie is approximately 2000 cubic feet per month per meter. A service charge of 50 cents per month to the average user would mean 25 cents per thousand cubic feet. As an average rate of $1.742 is what the company should receive, we believe that a service charge of 50 cents per month plus $1.50 net per thousand cubic feet of gas sold, would be a proper charge for the Sault Ste. Marie Gas & Electric Company to make. This means a rate to the average user of $1.75 per thousand cubic foot."

The subsequent case of *Re Lansing Fuel & Gas Co.,* P. U. R. 1922B, 605, before the same commission, however, illustrates the recent tendency to eliminate service charges because of popular objection. The commission said, pp. 607-8:

"The city of Lansing has for a long time applied the service charge in its water works department, and we think wisely so; but, it is generally true that a municipality can put in force a rate or charge, with less public disturbance than a privately-owned utility can.

"This service charge has been in force in Lansing for a year. The mayor recently testified before this Commission that a very large majority of the gas users want the service charge removed. Assuming that his estimate is correct, and the users having had a year to consider and study this charge, we feel its removal will have a tendency to bring about a better relationship between the gas company and the public which is always to be desired.

"It is the duty of this Commission to see that a utility gets a rate which will allow it sufficient revenue to pay its legitimate expenses, including taxes; create a sufficient reserve to take care of depreciation, and to pay its owners a return commensurate with the quality of the service rendered. This is not only fair, but necessary to insure continuity of service.

"On the other hand, it is the duty of this Commission to see that the consumers do not pay more than the quality of the service rendered is entitled to.

"Lansing needs the gas company and the gas company needs customers and the goodwill of the public.

"With these matters in mind and with a desire to carry out the public will, where no injury will attach to the parties, the service charge will be removed. In doing this, it must be understood that this Commission is not surrendering its convictions that a service charge comes nearer to doing exact justice to the gas users than the flat rate does.

"One great trouble has been that the public has not fully understood just what this service charge means. Some have had the impression, and probably

have it yet, that this is a charge which the gas company makes for reading the meter. Some have the impression that it is a rental of the meter. Others have the impression that by removing the service charge the rate of $1.25 per 1,000 cubic feet, will remain. These are erroneous ideas.

"We are of the opinion that when the public comes to understand what this readiness-to-serve charge really is, there will be a demand for it."

In the late case of *Re Webb City & Carterville Gas Co.,* P.U.R. 1922C, 608, the Missouri commission likewise yielded to local opposition and disallowed a service charge in the rate, saying, p. 620,

"In view of the strong opposition of consumers to a service charge on account of the general misunderstanding of the theory and reasonableness of such charge, it appears best for all parties that the service charge be eliminated."

The opinion of the Massachusetts Commission in the recent case of *Re Malden & Melrose Gas Light Co.,* P. U. R. 1922C, 545, is devoted almost wholly to the general matter here under discussion, i. e. the correctness of the principle of a charge separate from and in addition to the commodity rate, and the proper way of computing it. The company proposed a service charge ranging from 50c to $5.75, depending on the meter size, and $1.20 per M for gas. The commission approved a flat 35c service charge and a rate of $1.25 for gas. The company's request was in substance for a service charge to cover consumer costs of 37½c and "fixed charges on the meter and its setting," ranging from 14½c to $5.71. The commission in effect approved the former, and disregarded the latter. It said, pp. 546-8,

"The company contends, in brief, that there are certain definite and ascertainable expenses which are incurred either specifically for each individual customer served or are of such character that they are determined by the number of customers rather than by the amount of gas sold. Such expenses obviously include the investment charge for and the maintenance of the service pipe from the street main to the customer's premises and the meter installed thereon, as well as the taxes and depreciation on the same; and also the expense of reading the meter, keeping the customer's account and rendering and collecting his bills. It is equally obvious that, so long as the customer remains such, he will occasion these expenses to the company even though no gas is used. Under the present method of charge, such expenses are averaged with all other expenses and covered in the unit price for gas consumed." * * *

"From these facts it seems manifest that customers using little or no gas, but desiring nevertheless to have their premises connected with the company's mains, not only contribute little to the company's revenue, but not enough to cover the company's out-of-pocket expense incurred solely for them. It is to correct the inequality resulting from the present rates that the company is proposing a service charge. The question is, therefore, not primarily one between the company and its customers, but rather between the customers themselves as to the most equitable method for raising a given amount of revenue. With this as the real issue and recognizing the merit of dividing the rate into a definite service or customer charge and a selling price based upon the units of gas used rather than the uniform selling price now employed, we have been disposed to approve the adoption of such a scheme of charging within reasonable and proper limits whenever a company deems this step expedient. The question, therefore, to which we have chiefly directed our attention has been the amount of the service charge to be approved.

"Under the service charges proposed the company would have recovered during the last fiscal year an amount nearly

equivalent to all of its operating expenses exclusive of production expenses and taxes. In the three preceding years, while no analysis of the business sufficient for an accurate estimate of the revenue from such service charge exists, it seems probable that it might have exceeded such operating expenses. It is true that in the company's computation the fixed charges on meters and their installations and on the service pipes constitute about 15 of the 50 cents base charge. Conceding this 15 cents to be an appropriate element in the charge, we are not convinced that all of the other expenses included by the company in its computation are to be attributed to a customer, as such, merely because he chooses to be connected to the company's mains. Nor are the expenses of the last fiscal year used by the company necessarily typical. Certainly a computation made on the same basis as that used by the company for any of the three preceding years would have given quite different results. The function of any such computation is not so much to demonstrate the exact amount of the charge, but rather to test the reasonableness of such charge as expediency and convenience may suggest.

"With these considerations in view, a majority of the Commission are disposed to approve a base service charge of 35 cents."

The case of *Lebanon* v. *Lebanon Gas & Fuel Co.,* P. U. R. 1922D, 563, involved an out-and-out 3-part rate. The Pennsylvania commission there denied the company the right to put such a rate in effect. The company's division of costs was such that only 28.7% of the total revenue would be realized from the output or commodity charge. This led the commission to disapprove the form of schedule entirely. The opinion is worth quoting in full:

"At the hearings and in arguments the outstanding question which developed was whether a so-called three part rate which the Lebanon Gas & Fuel Company had filed was unjust, unreasonable, and discriminatory.

"It is a radical departure from the customary form of rate structure, applicable to artificial gas companies in Pennsylvania, and is not in harmony with the practices of this company as disclosed by former rate schedules, which adhered to a two-part rate, consisting of demand and consumption elements.

"Under the three-part rate which is the subject of attack in this proceeding, respondent's patrons are subjected to (a) a customer's charge, (b) a demand charge and (c) a consumption charge.

"The first of these, the customer's charge, is essentially the same as a service charge as generally designated. The demand charge, as used in this rate schedule, is an innovation in rate making in Pennsylvania, and is a fixed charge per customer based upon a demand rating determined by the number and kind of appliances installed in house or place of business for the consumption of gas. It might be designated an appliance charge.

"The consumption charge is based on quantity of gas consumed and is essentially the same as the output or consumption charge as these terms are generally understood.

"The theory upon which respondent attempts to support the three-part division of its rates is that the (b) demand charge covers, after the meter and billing expenses of the customer are cared for by the (a) customer's charge, a certain cost to the respondent which it must incur in holding its plant in a state of readiness to serve a capacity or peak load.

"In analyzing the effect of such rate allocations it appears that only about 28.7 per cent of respondent's total revenues accrues to it from the consumption charge (variable with the amount of gas consumed). The remainder of the revenue is chargeable to patrons irrespective of consumption. A segregation is unjustifiable in which only about one-fourth of total revenues is applicable to the con-

sumption elements and nearly three-fourths to non-consumption factors constituting fixed charges upon consumers whether gas is or is not consumed by them.

"The inequalities of such a rate schedule division are so apparent that it is not at all essential to point out by specific illustrations the instances of injustice bound to arise.

"It was not apparent from the testimony that the total revenue which respondent is receiving is greater than it is entitled to receive, but the distribution of the rate burden upon consumers is inequitable, unjust, unreasonable, and unduly discriminatory.

"The three-part rate schedule P. S. Pa. No. 6, effective March 27, 1921, cannot be sustained. The respondent will be directed within thirty days to prepare and file with the commission a new rate schedule in elimination of the three-part plan. In the formulation of the new rates, a conference with representatives of the Commission and engineers for respondent and complainant is directed, and, if agreement cannot be reached by them, respondent may file a tariff which can be made the basis for further inquiry and order by the Commission.

"The complaint to the extent indicated is sustained."

The California commission has recently joined the growing group which has yielded to public disapproval of the service charge *In Re Willits W. P. Co.* P. U. R. 1922E, 662, it said:

"Applicant desires the establishment of a form of rate which consists of two separate charges, one a service charge and the other a charge for water consumed. Such a form of rate, while theoretically logical and entirely equitable, is not generally understood by consumers and has in some instances resulted in distrust and discord. The rate established herein will, therefore, follow the customary practice in such cases."

A recent decision of the Kansas commission, however, shows a tendency in quite the opposite direction. In the *Kansas Natural Gas Company* and the *Empire Natural Gas Company* cases, decided March 21, 1923, the commission authorized in a large number of cities in that state a rate for natural gas consisting of three separate items; i.e., a customer charge of $9 per annum payable monthly, a demand charge of 32c per cubic foot of maximum hourly demand, and a consumption charge of 40c per M. The opinions in these cases are set forth in full in a special bulletin issued by the Association in April of this year.

On July 24, 1923, the Illinois commission authorized in Chicago an industrial gas rate consisting of two separate items, a demand charge and an output charge, stating in its opinion that for this class of service a "rate should be provided in which the charge is based in part upon the rate of the maximum hourly demand of a particular consumer, thus applying to the field of gas rates a principle long ago adopted in the making of electric rates."

The attitude of the courts to date has been that the question of the form of rate structure is one for the discretion of the commission, and that judicial interference is unwarranted.

Where a company is in court merely upon the question of whether its property is being confiscated, it is perhaps logical enough for the court to decline to interfere if the rates as a whole are yielding a fair return upon the value of the property. It was so held in the *Wilcox* v. *Consolidated Gas Company* 212 U. S. p. 19, where the company had filed a bill to have the New York 80c gas act set aside as confiscatory. Having sustained the statute as against other objections, the

court declined to entertain the company's complaint that under a flat 80c rate some consumers were served at a loss. It said on p. 54:

"Lastly, it is objected that there is an illegal discrimination as between the city and the consumers individually. We see no discrimination which is illegal or for which good reasons could not be given. But neither the city nor the consumers are finding any fault with it, and the only interest of the complainant in the question is to find out whether, by the reduced price to the city, the complainant is upon the whole unable to realize a return sufficient to comply with what it has the right to demand. What we have already said applies to the facts now in question.

"We cannot see from the whole evidence that the price fixed for gas supplied to the city by the wholesale, so to speak, would so reduce the profits from the total of the gas supplied as to thereby render such total profits insufficient as a return upon the property used by the complainant. So long as the total is enough to furnish such return it is not important that with relation to some customers the price is not enough."

Where, on the other hand, a company is in court on a direct appeal from the order of a commission under the usual form of statute authorizing the court to pass generally upon the justice and reasonableness of the commission's action, it would seem much more doubtful whether the court should refuse to consider a plea that the rates established by the commission distributed the cost unfairly among the consumers, particularly where such a condition might result in hampering the legitimate growth of the company's business. However, the courts have in such instances, nevertheless, followed the rule stated in the *Wilcox case,* above, and have held that the company cannot complain if the return as a whole is sufficient. Thus in *Public Utilities Commission* v. *Springfield Gas and Electric Company,* 291, Ill., 209, 228, the court said:

"It is also contended by appellee that the cost of supplying gas to the small consumer is greatly in excess of the amount allowed in the schedule established by the commission, and that the burden of paying the return on the capital invested is placed on one-third of the output of gas, i.e., the third taken by the large consumers. The point here in question was passed upon by the Supreme Court of the United States in *Willcox* v. *Consolidated Gas Co. supra,* where objection was made on behalf of the company to the reduced rate fixed for gas supplied to the city.

* * * * *

"Similar contentions were made in *Puget Sound Traction, Light and Power Co.* v. *Reynolds,* 244, U. S. 574, 37 Sup. Ct. 705. The company there contended that because two lines of the street railway forming a part of its railway system did not pay even operating expenses under a five-cent fare, the order of the Public Service Commission of the State of Washington establishing a five-cent fare for the system as a whole was illegal. The Supreme Court collects and discusses authorities on the point, and holds that if the net earnings of the whole system are sufficient to produce a reasonable return to the utility, the courts will not concern themselves with the details of rates established by the rate-making authorities. To the same effect is the holding of this court in *People* v. *St. Louis, Alton and Terre Haute Railroad Co.* 176 Ill., 512, and *Chicago Union Traction Co.* v. *City of Chicago, supra.*"

The New York court of appeals in affirming the legality of a service charge took the same view. *City of Rochester* v. *Rochester Gas & El. Corp.,* 233 N. Y. 39, 134 N. E. 828. The court said:

" * * * We see no escape from the conclusion that a service charge, reasonably computed, and moderate in amount, does not involve per se an illegitimate discrimination between classes of consumers. Into the computation of this charge, we are not required to enter, except in so far as it may be thought to involve a rent for the use of meters. The question propounded to us in the submission is

whether such a charge is unlawful 'regardless of the amount thereof.' We do not mean to suggest that the classification is one which the Commission *must* accept. Considerations of advantage are to be weighed with those of inconvenience. The balance may be found to be in favor of other methods of graduation, of other groups and classes. That is a question calling for the exercise by the Commission of its own judgment and discretion. The courts will not interfere with the conclusion except to safeguard the consumer against arbitrary power. *People ex rel. N. Y. & Queens Gas Co.* v. *McCall,* 219 N. Y. 84, 113 N. E. 795, Ann. Cas. 1916E, 1042, affirmed 245 U. S. 345, 38 Sup. Ct. 122, 62 L. Ed. 337. The business of rate making has been confided by the Legislature to a body of experts with powers of inquiry and modification adequate to the task. We are not required either to approve or to condemn the wisdom of the plan adopted. We are concerned with power only."

In sustaining the *power* of the commission to set up such a rate structure, however, the court used excellent language. It said:

"The expenses of a gas company are incurred partly in manufacture and partly in distribution. Its income must be adequate to reimburse it for the one outlay as for the other. Expenses of manufacture may be apportioned among consumers in proportion to the quantity of gas consumed. Expenses of distribution in their division may follow other lines. Some remain constant whether consumers are few or many. Others increase or diminish at a uniform rate with the number of the patrons. A service charge is an attempt to make the incidence of the burden as wide as the incidence of the benefit. From all the items included in the cost of distribution it segregates, and divides per capita, those dependent upon numbers. Such items there always are. Whenever a building is connected with a main, there is expense which continues while the connection is maintained. This expense will be the same though only a trifling quantity of gas, or even none at all, is used by the householder requiring the connection. In the absence of a service charge, or some similar device, there is the benefit of facilities, which would otherwise be needless, without the burden of contributing to the cost of supplying or maintaining them. The householder who closes his dwelling for the summer, and pays nothing in the interval, shifts the cost of maintenance incurred in his behalf to the householder whose dwelling is open throughout the year. The occupant who consumes something, but not enough to pay his share of the expense, is carried by his neighbors when rates are increased to compensate for profitless accounts. Sometimes this result is avoided through the device of a minimum bill, which differs from a service charge in this only, that the charge is absorbed and disappears when the minimum is reached. For the man who does not take anything, or less than the amount prescribed, the two devices are the same. Each is an expedient for maintaining the equilibrium between service and requital."

However, where the companies have succeeded in convincing the commissions, the courts have not seen fit to interfere.

In *State* v. *Sloan,* 139 La. 881, 72 So. 428. (1916) the supreme court of Louisiana held that where a statute made it unlawful to charge for more gas or electricity than was measured by the meter, it was, nevertheless, lawful to add to each bill for electricity a service charge of 25c. The language of the opinion shows that the court appreciated the character of "demand" costs. It said:

"The question is whether the said 25 cents charge, thus made 'for service,' was made 'for electricity.' Of course, the customer pays the bill in order to have electricity, and in that sense the charge is made for electricity. But in another sense, it is not made for electricity, but 'for service,' and the bill on its face shows it.

"The reason why this separate charge

is made is this. Electricity cannot be economically stored, and yet the supply must be in constant and immediate readiness on the touch of a button or the turn of a switch. This necessitates the installation and keeping up of a plant and equipment adequate to produce the quantity needed at such times as the demands are heaviest, and not only the quantity which at such times is actually demanded, but also the quantity which might be demanded, and necessarily all that part of this preparation which, at those times when the demands are light, is not called into requisition and especially all that part which might, at any moment, be, but never in fact is, called into requisition, is idle and profitless.

"The expense of the preparation thus not utilized, together with that of making connections with the premises of customers and the furnishing of meters, being more or less fixed, is sought to be provided for by this fixed 25 cents' charge, denominated 'for service,' while the current actually produced and consumed is charged for according to meter reading, at a rate which has been arrived at after taking into consideration this service charge. In other words, this service charge does not represent a bonus to the company, but has been devised as a means of more equitably apportioning among the customers of the company the expenses incident to the installation and operation of the plant."

The case of *Rivelli* v. *Providence Gas Company, supra,* wherein the supreme court of Rhode Island reached a similar conclusion, has already been referred to.

It is not unreasonable to believe that as the courts become more familiar with such matters, they may evidence a willingness to inquire further into the merits of rate orders than heretofore, particularly when the validity of the order is before them not merely on the issue of confiscation but upon the broad ground of its justice and reasonableness in the light of the evidence. Certainly, the fact that a company's business is as a whole profitable will not justify grossly unreasonable classifications. Thus it was held in *Northern Pacific Railroad* v. *North Dakota,* 236 U. S. 585, 604, that a state statute which segregated a single commodity and imposed upon it a rate which would compel the carrier to transport it for less than the proper cost of transportation was in excess of the power of the state.

On the whole, it seems to be a fair inference from the foregoing decisions, and many others of the same general character which are to be found in the books, that the courts and the commissions, while naturally not acceding in full to the utmost contentions of the companies, have, in most cases, gone about as far in utilizing cost analysis as a basis for rate structure as the evidence presented to them has warranted.

APPENDIX D

Report of Committee on Rate Structure

TABULATION OF TYPES OF RATES

A. G. A. Rate List No. 1

Combination With	Block Rate	Block Service*	Flat Rate	Special	Total
No Minimum Bill	57 (1)		43 (3)		100
Monthly Minimum Bill	397 (18)	90 (17)	170 (29)		657
Service Charge	83 (3)		44 (6)		127
Block for Heating	4	3	3		10
Block—Industrial	13	10	22		45
Flat—Industrial			5		5
Optional—3 Part	1	2	5	1 (a)	9
Optional—Demand	4	2	2	1 (b) 1 (c)	10
Quantity Discount			1		1
	559	107	295	3	964

Note: Figures in parentheses are items also classified elsewhere.
*Block rates where the element of service charge is included in first block.
(a) Bristol, Tenn. general 3 part rate.
(b) Baltimore (Demand).
(c) St. Louis (Demand-Block).

APPENDIX E

PREPARATION OF RATE CASES

F. C. Hamilton, New York, N. Y.

The Rate Structure Committee feels that it would be of assistance to the industry and to various regulatory bodies if all rate cases submitted were prepared in accordance with certain principles and along standard lines.

The following outline indicates the necessary data to be presented before the regulatory body. The technical preparation necessary in the presentation of this data divides itself into two principal parts. The first of these is the determination of the *amount of money* necessary to pay operation, maintenance and retirement expenses and a fair return on the value of the property. The second part is the determination of the proper *method of raising the money.* Care should be taken to keep the two questions separated as much as possible, for it often happens that in an argument over whether the company should have 6 per cent on $2,000,000 or 8 per cent on $3,000,000, the equity or inequity of the rate structure is often forgotten.

The above principal parts can be subdivided as follows:

1. Valuation of the property.

2. Earnings of the company under present and proposed rates.

3. The Company's side of the rate question.

An analysis of the cost entering into the final delivery of the commodity to the customer with the view to determining a definite rate, which will be high enough to yield the necessary revenue and the structure of which will accord with scientific principles.

4. The Customer's side of the rate question.

Analyses of the accounts of the customers and the costs of serving different customers in order to show the effect of the proposed rate and to make comparisons with other rates.

On the following pages is given the suggested outline of exhibits to be prepared, the exhibits themselves being numbered serially, while the explanatory sheets are numbered 1A, 2A, etc.

1. VALUE OF PROPERTY
March 31st, 1923

Summary of Appraisal	
Real Estate	$———
Buildings and Structures	———
Plant Equipment	———
Distribution System	———
General Office Equipment	———
Utility Equipment	———
Working Capital	———
Materials and Supplies	———
Total Value	$ 2,000,000.00

1. VALUATION

A complete valuation of the property should be prepared and a valuation report submitted on the basis of the cost to reproduce the property new as of the date of the application.

It is true that some of the state commissions have endeavored to establish

valuations on the theory of original cost, pre-war prices or average prices over past years, but the rule of the courts is that public utility companies are entitled to earn a return upon the *value* of their property rather than upon the original cost.

There is only one rate base that will finally stand the test of economics and of the law and that is the cost of reproduction new of the property.

For use in connection with the preparation of arguments and briefs, the following list of citations upon this subject is submitted:

Reproduction Cost New

Smythe vs. Ames, 169 U. S. 466.

Wilcox vs. Consolidated Gas Co. 212 U. S. 19 reported. Consolidated Gas Co. vs. City of New York, 157 Federal, 849.

Denver vs. Denver Union Water Co. 246 U. S. 178.

Minnesota Rate Cases, 230 U. S. 350.

Elizabethtown Gas Light Company vs. Board of Utility Commission of New Jersey P. U. R. 1920 F 1001.

Detroit vs. Michigan Railroad Commission 177 Northwest 306.

Southwestern Telephone and Telegraph Company vs. City of Fort Worth, Northwestern District of Texas, Fort Worth Division.

State of Missouri, ex Rel Southwestern Bell Telephone Company vs. Missouri Public Service Commission et al, P. U. R. 1923 C.

Bluefield Water Works and Improvement Company vs. West Virginia Public Service Commission P. U. R. 1923 D.

Monroe Gas Light and Fuel Company vs. Michigan Railroad Commission. Decision dated July 3, 1923, decision of Judge Denison, Circuit Judge and Judges Tuttle and Simon, District Judges, sitting as a statutory court for the Eastern District of Michigan.

2. EARNINGS STATEMENT

	Year Ending March 31st 1923	1922
1. Gross Revenue	$ 530,000	$ 500,000
2. Operation and Maintenance	420,000	400,000
3. Income Available	110,000	100,000
4. Retirement Expense ..	30,000	30,000
5. Net Income	80,000	70,000
6. Value of Property ...	2,000,000	1,900,000
7. Per Cent Return	4.0%	3.7%
8. Net Income as above .	$ 80,000	
9. Increase / Decrease on Proposed Rate ..	75,000	
10. Net Income on Proposed Rate	155,000	
11. Per Cent Return	7.75%	

2. EARNINGS STATEMENT

A complete analysis of the accounts of the company should be made for the purpose of showing the net income available for depreciation and return upon the fair value of the property.

This may be made for any period for which it may be deemed best in order to show the true financial condition of the company. The period may be less than a year or it may be for several years prior to the hearing. Although a detailed analysis must be made, it is well not to burden the record with it unless requested. It is felt that the exhibit showing the net income should be made in the form of a very simplified financial statement. The supporting data behind the exhibit may be developed by examination or cross-examination. The suggested form for presentation is given on the previous page.

Details as to number of customers, sales and revenue by months, substantiating line 1 of page 4.

	Number of Custmrs.	Sales in M Cu. Ft.	Revenue in Dollars
1921			
April			
May			
June			
July			
August			
September			
October			
November			
December			

	Number of Custmrs.	Sales in M Cu. Ft.	Revenue in Dollars
1922			
January			
February			
March			
12 Months Ending	12,250	360,000	$500,000
April			
May			
June			
July			
August			
September			
October			
November			
December			
1923			
January			
February			
March			
12 Months Ending	13,000	380,000	$530,000

Summary of Expenses

	1923	1922
Production	$———	$———
Distribution	———	———
Customer	———	———
General	———	———
Taxes	———	———
Total	$ 420,000	$ 400,000

Substantiates Line 2 of Earnings Statement.

Effect of Proposed Rate

13,000 Customer Charges at	$12.00 =	$155,000
650,000 Cu. Ft. Demand at	.40 =	260,000
380,000 M Cubic Feet at	.50 =	190,000
Total		$605,000
Present Revenue		530,000
Increase		$ 75,000

Substantiating Line 9 of Earnings Statement.

3. RATE STRUCTURE

Allocation of Property

Item	Demand	Customer	Commodity	Total
——	———	———	———	———
——	———	———	———	———
——	———	———	———	———
——	———	———	———	———
Total	$ 1,060,000	$ 880,000	$ 60,000	$ 2,000,000
Per Cent	53%	44%	3%	100%

Allocation of Operating Expenses

Item	Demand	Customer	Commodity	Total
——	———	———	———	———
——	———	———	———	———
——	———	———	———	———
——	———	———	———	———

Total Operation	$ 198,000	$ 126,000	$ 96,000	$ 420,000
Retirement Exp.	15,900	13,200	900	30,000
Return	84,800	70,400	4,800	160,000
Total	$ 298,700	$ 209,600	$ 101,700	$ 610,000

Total Demand in Cubic Feet ..	650,000	
Demand Expense per Cu. Ft. per year		46c
Total number of customers ...	13,000	
Customer Expense per year		$ 16.10
Total gas sold in M Cu. Ft. ..	380,000	
Commodity Expense per M Cu. Ft.		$ .268

3. ANALYSIS OF COSTS

In order to intelligently charge for service, it is necessary to know the cost of that service. There is a very general agreement that an equitable allocation can best be made by considering the cost of gas service to consist of three parts:

(1) Commodity Expense; (2) Customer Expense, and (3) Demand Expense. The method of making this allocation has been covered in detail in part two of this report and a summary is shown on the previous page.

These three parts may be briefly defined as follows:

(1) The Commodity Expense is that part of the expense of producing, transmitting and distributing gas, which is proportional to the amount of gas handled. To be classified under "Commodity," an item must be of such a nature that it ceases when output ceases or increases as output increases.

(2) Customer Expense—About one-half of the company's total investment is in its delivery system, mains, meters and services. The bulk of the cost of this delivery system is directly occasioned by the company having a large number of customers instead of only a few and bears little relation to the quantity of gas used. In theory, therefore, Customer Expense includes about one-half of the company's fixed charges and general expense to-

gether with meter reading, billing and other expenses directly proportional to the number of customers.

(3) Demand Expense includes the remainder of the fixed charges and such of the operating expenses as are proportional to the rate at which the customer uses gas.

SCHEDULE OF RATES FOR GAS SERVICE

Available to any customer located on the mains of the Company.

Rate—Three Part

1. A Consumption Charge—
   per 100 cubic feet of gas metered per month ..... $ .05

Plus

2. A Demand Charge—
   Per cubic foot of maximum hourly demand, per year .... .40

Plus

3. A Customer Charge—
   Per meter, per year 12.00

Determination of Demand

At the option of the customer, the demand for customers using 3 or 5 light meters may be estimated, measured or agreed upon by contract. If estimated, the demand shall be taken as 50 cubic feet per hour, giving a yearly demand charge of $20.00, or $1.67 per month. If measured, the maximum 5-minute flow shall be taken as the basis for computing the demand charge. Demands agreed upon shall be by contract covering a certain definite connected load and operating period; none of which shall be varied without the consent of the company.

The demands of residence and industrial customers with 10 light and larger meters shall be measured.

In any case, where a customer has paid for an estimated, measured or agreed demand, the Company shall have the right to limit the rate at which he uses gas to such demand; such limitation to be effected by such means as the Company deems necessary in the interest of good service.

Discount—None.

The above net rates apply only in case a bill is paid within ten days after the expiration of the period for which service is rendered. If not so paid, the gross rates, which are the above rates, plus 10 per cent, then apply.

Special Rules

If a meter is disconnected it shall not be reconnected at the same address and for the same customer (or any member of his family) except upon payment of a reconnection charge of $5.00.

A definite recommendation should be made as to the rate with such changes as to exact amount of the three charges as may be shown to be necessary from the analysis of costs.

The subdivision of demand costs along the lines outlined in Appendix A of this report does not mean that in the presentation of a rate case and the proposal of a specific rate there should be suggested two separate demand charges. The schedule should call for only one demand charge, for billing purposes. However, the schedule as proposed, may well provide for a rate of charge for 24-hour demand, the amount of such demand to be determined by some method specifically set forth and provide that such demand charge may, in proper cases, be added to the hourly demand charge provided for in the main part of the schedule set out above.

It may be in some cases the present net income is sufficient and satisfactory and it is only necessary to change the form of the rate to the Three-part Rate. In that case, the analysis of costs and form of rate, herewith recommended, would still apply.

4. CUSTOMER DATA

Comparison of Cost to Serve

Mr. A is a successful business man of the city. He either dwells in an apartment already heated and supplied with hot water or occasionally lives in his large residence, but his use of gas is occasional and a mere matter of temporary convenience. His average monthly consumption is less than 1,000 cubic feet.

Mrs. B is the wife of a working man, lives in a very modest home and does her own cooking. She is practically dependent on gas and uses an average of 4,000 cubic feet a month.

On the present meter rate, the average monthly gas bill of Mr. A is $1.40 and that of Mrs. B is $6.40.

From the analysis of costs shown before, the consumption expense is about $ .30 per 1,000 cubic feet. Subtracting this consumption expense from each of these bills, we get the balance to cover all other expenses of:

	Mr. A	Mrs. B
Gas Bill	$ 1.40	$ 6.40
Less Gas Cost	.30	1.20
Balance for other costs	$ 1.10	$ 4.40

Each of these customers has a 5-light meter, the same maximum requirements and the investment of the company necessary to serve each is the same. The mains must be kept in shape as much for the one as for the other. It costs just as much to read A's meter, make out his bill and handle his account as it does for Mrs. B. The company's taxes, insurance, etc., are the same for both. It costs just as much to deliver the 1,000 cubic feet to Mr. A as the 4,000 cubic feet to Mrs. B.

What right has the company to charge Mrs. B four times as much for exactly the same service as Mr. A gets for $1.10?

Customer's Viewpoint

The preparation of any case to show the proposed rate from the viewpoint of the customer is very important. It is the part in which Commissions, newspapers and the general public are most interested. In order to simplify matters, it is suggested that the amounts used in this section be mainly those applicable to a single average customer: as, for instance, the gross revenue to be raised being stated as $3.88 per month, instead of the entire earnings of the Company.

It is also urged that other rates be designed which would apparently bring the same amount as the rate constructed per section 3, and recommended and that comparisons of these rates be shown as well as comparisons of the present rate with the proposed one. (See pages 12 and 13).

Further analysis should be made of typical streets or sections occupied by:

1. Working people and others of moderate circumstances.

2. People of large means living in their own homes or apartments.

3. Stores and offices.

These analyses should show that ordinarily based on present consumption, some bills will be increased while others will be decreased. They should also show that it is not the poor man who is the one most affected.

Calculation of Equivalent Rates

Necessary Annual Gross Revenue Required (Page ——)		$605,000
Number of Customers	13,000.	
Monthly Revenue per Customer	$	3.88
Average Sales per Customer (cu. ft.)		2,440
Necessary Meter Rate, per thousand	$	1.60
Monthly Revenue as above	$	3.88
Service Charge, per month		1.00
Balance for Gas Charge	$	2.88
Price per Thousand	$	1.15

Proposed Three-part Rate

Customer Charge	$ 1.00
Average Demand Charge	1.66
Commodity Charge ($2.44 x .50)	1.22
Total	$ 3.88

The above calculations give us three rates, each of which, on present sales, yields the same revenue to the Company, $3.88 per month.

1. $1.60 per thousand.
2. $1.00 per month plus $1.15 per thousand.
3. Three-part Rate.

Comparison of Rates

Gas used by Custmr. in cu. ft. per mo.	Monthly Bill on Various Rates: $1.60 per M	$1.00 plus $1.15 per M	Three-Part Rate: small Custmr.	medium Custmr.	large Custmr.
500	$ .80	$1.57	$2.25	$	$
1000	1.60	2.15	2.50		
1500	2.40	2.72	2.75		
2000	3.20	3.30	3.00		
2500	4.00	3.87	3.25	3.92	
3000	4.80	4.45	3.50	4.17	
4000	6.40	5.60		4.67	
5000	8.00	6.75		5.17	5.75
6000	9.40	7.90		5.67	6.25

Note—Small Demand Customer figured at a demand charge of $1.00 per month; the medium, at $1.67 and the large at $2.25. The figures used here will, of course, depend on the method of charging for demand.

Who is the Small Customer?

1. Classification of Customers

Based on 2,000 accounts taken from all parts of the company's ledgers and representing all classes of customers.

Gas used by Customer Cu. Ft. per Month	Per Cent of Total Customers	Per Cent of Total Consumption
0 - 1000	9%	1%
1000 - 2000	18	7
2000 - 2500	20	13
Sub-Total	47%	21%
2500 - 3000	18%	15%
3000 - 4000	18	21
4000 - 5000	8	13
Sub-Total	44%	49%
5000 - 6000	5%	12%
6000 - 7000	3	10
Over 7000	1	8
Sub-Total	9%	20%
Total	100%	100%

2. Classification of Workingmen

Based on the accounts of the 500 workingmen and clerks in the above 2000.

Gas used by Customer Cu. Ft. Per Month	Per Cent of Total Customers	Per Cent of Total Consumption
0 - 1000	4%	1%
1000 - 2000	13	6
2000 - 2500	23	15
Sub-Total	40%	22%
2500 - 3000	21%	21%
3000 - 4000	33	46
4000 - 5000	6	11
Sub-Total	60%	78%
5000 - 6000	0%	0%
6000 - 7000	0	0
Over 7000	0	0
Sub-Total	0%	0%
Total	100%	100%

Analysis of the first——— accounts in a workingman's district.

Name	Address	Occupation	No. of Rooms	No. in Family	Monthly Consumption	Monthly Bill $1.70 Per M	Monthly Bill 3 Part Rate

Similar analysis of apartment customers.

Name	Address	Occupation	No. of Rooms	No. in Family	Monthly Consumption	Monthly Bill $1.70 Per M	Monthly Bill 3 Part Rate

Similar analysis of doctors and lawyers' offices.

Name	Address	Occupation	No. of Rooms	No. in Family	Monthly Consumption	Monthly Bill $1.70 Per M	Monthly Bill 3 Part Rate

Comparison of the Cost of Serving an average customer with the amount that customer will pay under the various forms of rates.

Gas Used by Customer in Cu. Ft.	Monthly Customer Expense	Monthly Demand Expense	Monthly Commodity Expense	Monthly Total Expense	Monthly Gas Bill: $1.60 per M Cu. Ft.	Service Charge Rate	Three Part Rate
0	$1.34	$1.92	$ —	$3.26	$ —	$1.00	$2.66
500	1.34	1.92	.13	3.39	.80	1.57	2.91
1000	1.34	1.92	.27	3.53	1.60	2.15	3.16
1500	1.34	1.92	.40	3.66	2.40	2.72	3.41
2000	1.34	1.92	.54	3.80	3.20	3.30	3.66
2500	1.34	1.92	.67	3.93	4.00	3.87	3.91
3000	1.34	1.92	.80	4.06	4.80	4.45	4.16
4000	1.34	1.92	1.07	4.33	6.40	5.60	4.66
5000	1.34	1.92	1.34	4.60	8.00	6.75	5.16
6000	1.34	1.92	1.61	4.87	9.60	7.90	5.66

Photograph of home of well-to-do small customer or of high priced apartment

This is the home of Mr. A, the so-called "Little Fellow" who will be over-charged (?) by any form of service charge rate.

On a rate of $1.60 per thousand, Mr. A's monthly gas bill will be only $1.60, since his family uses 1,000 cubic feet.

On the Three-part Rate his bill would be:

Customer Charge	$ 1.00
Demand Charge	1.00
Commodity Charge	.50
Total	$ 2.50
Increase over $1.60 rate	$ .90

Under the Three-part Rate, the Company would ask Mr. A to help out the steady customers by paying *one-fourth of a cent per hour* for his standby service.

The increase of $ .90 per month would not go into the Company's treasury, but would be paid back to the community through the saving in bills of the customers to whom gas is a necessity.

Photograph of home of working man who uses about 4,000 cubic feet a month

This is the house rented by Mrs. B, the customer who would save money on any service charge rate as compared to its equivalent straight rate per thousand.

Mrs. B averages 4,000 cubic feet a month, so her bill on a rate of $1.60 per thousand will average $6.40.

On the Three-part Rate her bill would be:

Customer Charge	$ 1.00
Demand Charge	1.67
Commodity Charge	2.00
Total	$ 4.67
Reduction from $1.60 straight meter rate	$ 1.73

In addition, Mrs. B will be able to save on her coal bill by replacing some coal with fifty cent gas.

The use of photographs of the homes of individual customers is strongly recommended, especially in a case where any member of the regulatory body is acquainted with the city under discussion.

Each photo should be accompanied with descriptive data as per previous pages. These will demonstrate to the commission and the layman the discriminatory nature of straight meter rates more quickly than any other method so far tried and a series of such pictures can also be used at the complaint desk with telling effect.

APPENDIX F

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PART II. ARTICLES IN JOURNALS

Arranged Chronologically, 1876-1923; partly annotated.

The work of collecting references to the literature pertaining to rates was begun in 1915 in order to enable the Rate Committee of The Peoples Gas Light & Coke Company of Chicago to make an exhaustive study of the principles of correct rate-making. This material has been brought down to date of July, 1923, for the Rate Structure Committee of the American Gas Association. The bibliography lists nearly 1500 items, each with one reference or more. Items are arranged alphabetically by authors under each year: items without author are alphabetical by title after the year's author list.

Students of rate-making in the employ of public service corporations or in classes at Schools of Commerce should by all means read the following famous rate papers: 1876, Morton; 1883 & 1898, Humphreys; 1891, Clark; 1892, Hopkinson; 1896, Green; 1896 & 1901, Wright; 1898, Insull; 1900, Doherty; 1906, Gardiner; 1911-12-13, Eisenmenger; 1916, Spitzglass (who epitomizes methods of the leading pioneers and reiterates clearly the basic principles).

Abbreviations Explained; In order to save space, names of journals have been abbreviated and references to dates, volumes and pages have been condensed by the use of a code. **Ex.**—A. G. A. Gen. Ses. Proc. 1922, 4:93-152, means American Gas Association, General Session of Annual Convention in 1922, printed in the Associations Proceedings in Volume 4 on pages 93-152.

Jl Elec 5-15-22 p. 393-6, 399, should be read: Journal of Electricity, issue of May 15, 1922, pages 393-6 and 399.

Key to Abbreviations used in References

, is used between year and volume number or between page references.

: between numbers means "volume—page—."

p between year and numbers (when volume number is unknown) means "page or pages."

abst—abstract.

bul—bulletin.

bur—bureau.

Aera—Monthly journal of the American Electric Railway Association.

Am Acad Pol & Soc Sc An — American Academy of Political and Social Sciences, Annals.

Am City—American City.

Am Econ Assn—American Economic Association.

Am Econ Rev—American Economic Review.

Am Elec Ry Assn—American Electric Railway Association.

Am Electn—American Electrician.

A G A—American Gas Association.

Am Gas Engg Jl—American Gas Engineering Journal.

A G I—American Gas Institute.

Am Gas Jl—American Gas Journal.

Am Gas Lt Assn—American Gas Light Association.
Am Inst Elecl Engrs—American Institute of Electrical Engineers.
Am Munic—American Municipalities.
Am Soc Civ Engrs—American Society of Civil Engineers.
Am Water Wks Assn Jl—American Water Works Association Journal.
Ark Assn Pub Util Op—Arkansas Association of Public Utility Operators.
Arm Engr—Armour Engineer.
Assn Elec Lt Engrs N. E.—Association of Electric Light Engineers, New England.
Assn of Ed Ill Cos—Association of Edison Illuminating Companies.
Balt Gas & Elec N—Baltimore Gas and Electric News.
Blast Fur & Steel Pl—Blast Furnace and Steel Plant.
Can Elecl Assn—Canadian Electrical Association.
Can Engr—Canadian Engineer.
Case & Com—Case & Comment.
Cass Mag—Cassiers' Magazine.
Cent Sta—Central Station.
Clev City Rec—Cleveland City Record.
Coal Ind—Coal Industry.
Coml & Fin Chr—Commercial & Financial Chronicle.
Comm—Commission.
Comrc—Commerce Reports.
Comtee—Committee.
Conf—Conference.
Cong—Congress.
Cons Rept—Daily Consular and Trade Reports.
Co (s)—Company (ies).
Conv—Convention.
Corp (s)—corporation (s).
Cur Op—Current Opinion.
Econ Wld—Economic World.
Ed R Tab—Edison Round Table.
Elec Jl—Electric Journal.
Elec Ry Jl—Electric Railway Journal.
Electn—Electrician, London.
Elec Trac—Electric Traction.
Elecl Age—Electrical Age.
Elecl Engr Lond—Electrical Engineer, London.
Elecl Engr N Y—Electrical Engineer, New York.
Elecl Rec—Electrical Record.
Elecl Rev Lond—Electrical Review, London.
Elecl Rev N Y—Electrical Review, New York.
Elecl Rev & West Electn—Electrical Review and Western Electrician.
Elecl Wld—Electrical World, New York.
Elecl Wld & Engr—Electrical World & Engineer.
Elek Kraft u Bahnen—Elektrische Kraftbetriebe und Bahnen.
Elektrotech Anz—Elektrotechnischer Anzeiger.
Elektrotech u Masch—Elektrotechnik und Maschinenbau.
Elektrotech Zeitschr—Elektrotechnische Zeitschrift.
Emp St Gas & Elec Assn—Empire State Gas & Electric Association.
Engg—Engineering, London.
Engg & Contr—Engineering and Contracting.
Engg & Min Jl—Engineering and Mining Journal.
Engg Mag—Engineering Magazine.
Engg News—Engineering News.
Engg N-Rec—Engineering News-Record.
Engg Rec—Engineering Record.
Engg Soc W Pa—Engineering Society of Western Pennsylvania.
Engr—Engineer, London.
Forum.
Gas Age—Gas Age.
Gas Age Rec—Gas Age-Record.
Gas Jl—Gas Journal, London.
Gas Indus—Gas Industry.
Gas Inst News—Gas Institute News.
Gas Rec—Gas Record.
Gas Wld—Gas World, London.
Gen Elec Rev—General Electric Review.
Genié Civil.
Harv Law Rev—Harvard Law Review.
Ill Gas Assn—Illinois Gas Association.
Inc Gas Inst—Incorporated Gas Institute.
Inc Munic Elecl Assn—Incorporated Municipal Electrical Association.
Ind—Independent.
Ind Elec Lt Assn—Indiana Electric Light Association.
Ind Engg Soc—Indiana Engineering Society.
Ind Gas Assn—Indiana Gas Association.
Indus Mngt—Industrial Management.
Instn Elecl Engrs—Institution of Electrical Engineers, London.
Instn Gas Engrs—Institution of Gas Engineers, England.
Intl Elec Cong of St. Louis—International Electric Congress of St. Louis.
Intl Gas Cong—International Gas Congress.
Iowa Gas Assn—Iowa District Gas Association.
Iron Tr Rev—Iron Trade Review.
Iso Pl—Isolated Plant.
Jl Accty—Journal of Accountancy.
Jl of Elec—Journal of Electricity.
Jl Elec Pow & Gas—Journal of Electricity, Power and Gas.
Jr Engg Soc—Junior Engineering Society, England.
Jl f Gasbel—Journal für Gasbeleuchtung.
Jl Gas Ltg—Journal of Gas Lighting, London.
Kansas G, W, E L & St Ry Assn—Kansas Gas, Water, Electric Light and Street Railway Association.
Lit Dig—Literary Digest.
Mag Wall St—Magazine of Wall Street.
Marine Rev—Marine Review.
Mass Bd Gas & Elec Lt Comrs—Massachusetts Board of Gas & Electric Light Commissioners.
Me Soc Civ Engrs—Maine Society of Civil Engineers.
Mich Elec Lt Assn—Michigan Electric Light Association.
Mich Gas Assn—Michigan Gas Association.
Minn Elec Assn—Minnesota Electric Association.
Minn Engr—Minnesota Engineer.

Minn Munic—Minnesota Municipalities.
Minn Univ Cur Prob—Minnesota University. Current Problems.
Monit Tech—Il Monitore Technico.
Mo Assn Pub Util—Missouri Association of Public Utilities.
Mo Rev—U. S. Monthly Labor Review.
Munic Engg—Municipal & County Engineering.
Munic Jl Lond—Municipal Journal, London.
Munic Jl & Engr—Municipal Journal & Engineer.
NCGA—National Commercial Gas Association.
NELA—National Electric Light Association.
Nation.
Natural Gas Assn—Natural Gas Association of America.
Natural Gas Jl—Natural Gas Journal.
Natl—National.
Natl Assn of Ry Comrs—National Association of Railway and Utilitiles Commissioners.
Natl Civic Fed—National Civic Federation.
Natl Munic Rev—National Municipal Review.
New Eng Assn of Gas Engrs—New England Association of Gas Engineers.
N J Munic—New Jersey Municipalities.
No Soc of Elecl Engrs—Northern Society of Electrical Engineers, Manchester, England.
N W Elec Assn—Northwestern Electric Association.
N W Elec Lt & Pow Assn—Northwestern Electric Light and Power Association.
N Y State St R R—New York State Street Railroad Association.
Ohio Elec Lt Assn—Ohio Electric Light Association.
Ohio Gas Lt Assn—Ohio Gas Light Association.
Ore Soc Engrs Jl—Oregon Society of Engineers Journal.
Ore Voter—Oregon Voter.
Pac Coast Elec Assn—Pacific Coast Electric Association.
Pac Coast Gas Assn—Pacific Coast Gas Association.
Pan Am Mag—Pan American Magazine.
Penn Elec Assn — Pennsylvania Electric Association.
Pol Sc Qtly—Political Science Quarterly.
Power.
Prac Engr—Practical Engineer.
Proc—Proceedings.
Prog Age—Progressive Age.
Pub Serv—Public Service Magazine.
Puget Sound Elec Jl—Puget Sound Electric Journal.
P U R—Public Utilities Reports, annotated.
Qtly Jl Econ—Quarterly Journal of Economics.
Rate R—Rate Research.
Rev Gen Sc—Revue Génerale Des Sciences pure et appliquees.
Ry Age—Railway Age.
Sat Eve Post—Saturday Evening Post.
Sib Jl—Sibley Journal of Engineering.
So Gas Assn—Southern Gas Association.
Soc Belge d'Elec—Belgian Electrical Association.
Soc for Elecl Develop—Society for Electrical Development.
Stone & W Jl—Stone & Webster Journal.
S W Electn—Southwestern Electrician.
S W Elecl & Gas Assn—Southwestern Electrical & Gas Association.
S W Gas Elec & St Ry Assn—Southwestern Gas, Electric and Street Railway Association.
Tech Wld—Technical World Magazine.
Telephony.
Texas Munic—Texas Municipalities.
Toledo City Jl—Toledo City Journal.
Trans—Transactions.
U N P—Universidad Nacional de la Plata.
Util Mag—Utilities Magazine.
W Am Elect—Western American Electrician.
West Gas Assn—Western Gas Association.
West Soc of Engrs Jl—Western Society of Engineers Journal.
Wis Elec Assn—Wisconsin Electric Association.
Wis Elec & Gas Assn—Wisconsin Electric and Gas Association.
Wis Engr—Wisconsin Engineer.
Wis Gas Assn—Wisconsin Gas Association.

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Differential vs. uniform prices for gas. Jl Gas Ltg 6-4-81, 37:1011. (Cash discounts and near distance of supply discounts have certain reasons for existing.)

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discussion leading to the resolution that it is advantageous in certain cases, though not always justifiable.)

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Woodhall, H.—Differential charges for gas. Jl Gas Ltg 7-8-88, 52:16-17; Instn Gas Engrs Trans 1888. (Strong arguments in favor of differential rates. Consideration of customer expenses. Sliding scale of dividends interferes with the natural development of differential rates.)

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De Camp, A. J.—Cost of products to central station. NELA Proc 2-4-90, page 137. (Classification of central station expense & differential between day lights, evening lights & all night lights.)

Faben, Jr., C. R.—Graduated vs. uniform rates. Ohio Gas Lt Assn Proc 1890.

Lufkin, H. L.—Proper basis for determining electric motor rates. NELA Proc 8-20-90, vol. C. 12, pages 237-67. (Methods of adjusting maximum demand charge for various services of motors.)

Cost of coal & price of gas. Jl Gas Ltg 1890 56:785-93.

Graded vs. uniform charges for gas. Prog Age 5-15-90, 8:209-11. (Discusses meter rent to cover cost of individual service, meter, billing, etc. General opinion not to have discounts allowed for either quantity or use of product.)

1891—**Clark, Walton**—Meter rents: a question of equity & policy. Am Gas Lt Assn (Oct. 1891) 9:517. (Advocates customer charge to cover investment expenses occasioned by the individual customer; also cost of billing, collecting & attending to one customer.)

Earnest, E. G.—Differential prices & one meter. Jl Gas Ltg 4-7-91, 37:637-642. (June consumption in small town considered cooking load to be charged at a lower rate.)

Marks, W. D.—How to get paying loads for stations. Assn of Ed Ill Cos 1891.

Newbigging, Thomas — Differential rates. Jl Gas Ltg 9-1-91, 58:392-96, 1039. (Objects to differential rates.)

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Regulation of price of gas in U. S. A. Jl Gas Ltg 1892, 60:723.

1893—**Forstall, A. E.**—Rates. Am Gas Lt Assn 1893.

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Livesey, Sir George—Differential prices for gas. Jl Gas Ltg 5-16-93, 61:670-933. (Discounts to large customers should be limited to small percentages. Large companies can afford uniform rates.)

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63:1222; Instn Gas Engrs Trans 1894, 64:11. (Arguments against Livesey's stand on differential rates.)

Crompton, R. E.—Cost of electrical energy. Inst Gas Engrs 1894.

Gibbins, A. H.—Methods of charging for electricity. Elecl Rev Lond July 27, Aug. 3 & 10, 1894. (Comparison of existing methods.)

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1896—**Anderson, G.**—Differential rates. Gas Wld 1896, 24:910. (Arguments for differential rates.)

Farnsworth, A. J.—Charging for electric lighting service. Elecl Engr N Y 6-3-96, 21:589. (Apportionment of expenses: Class A, those which shall be equally shared by all consumers; Class B, those which should be divided among consumers in proportion to their equipment; Class C, operating expenses.)

Green, W. J.—A method of calculating the cost of furnishing electric current & a way of selling it. Elecl Wld 2-29-96, pages 222-3; Rate R 1912, 5:195 & under Books 1915. (First article to give the subdivision of cost into items proportional to capacity, (demand) customer and output. Very elaborate apportionment of expenses. Fixed and individual charges.)

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Maycock, W. P.—The maximum demand system of charging for electrical energy. Elecl Rev Lond 10-21-96. (Explanation of existing system.)

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Sprague, F. J.—Electric elevators. Am Inst El Egrs 1896 vol. 11.

Wright, Arthur—Cost of electricity. Read before the Conv Borough Elecl Engr & Brighton, Eng 6-11-96; Rate R 1913, 2:359 & under Books 1915. (Fixed charge maximum demand; running cost Wright demand system output. Block' system of charges, each block being a function of customers, maximum demand.)

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Copley, I. C.—Selling gas. Westn Gas Assn Proc 1897 194-9; Prog Age 6-1-97, 15:229-30. (Essential conditions and gas for fuel.)

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(Motion duly made, seconded, and carried that the report of the Committee on Rate Structure be accepted and printed in the Proceedings.)

REPORT OF COMMITTEE ON STANDARDIZATION OF GAS APPLIANCE SPECIFICATIONS

W. T. Rasch, *Chairman*, New York, N. Y.

The Committee on Standardization of Gas Appliance Specifications submits the following report for the year 1923.

During the year the committee prepared specifications on gas-fired steam boilers, gas-fired steam radiators and water heater cocks, and revised the existing gas range specifications. These specifications, with the exception of the gas range specifications, are to be tentative for a period of one year. This gives the members of the Association ample time to suggest changes in the specifications, before they are finally adopted.

The gas range specifications, which have been revised have had added to them a performance specification as Exhibit C. The committee feels that this addition is one which will materially help to make the specifications thoroughly practical. They embrace burner capacities, burner operating characteristics, lighters, adjustable orifices, fire hazard, flue gas analysis, oven heat distribution, thermostat, relief for explosion and leakage.

There will also be found a drawing of the official marking for appliances conforming to A. G. A. standard specifications.

The committee suggests that the 1923-24 Committee on Standardization of Gas Appliance Specifications devote some of their energies to writing specifications for room heating appliances, particularly to the radiant type of room heaters and to water heater specifications.

(Motion made, seconded and carried to adopt the revised Gas Range Specifications and approve the committee's recommendations that the specifications covering Standard Water Heater Cocks, Standard Code for Testing and for Rating Gas-fired Steam Boilers, and Standard Code for Testing and Rating Unvented Gas-fired Steam Radiators, be tentatively put into effect for one year from date.)

For full text of specifications see pages.

The president then invited Mr. F. A. Lemke, chairman of the Manufacturers' Section, to occupy the chair during the presentation of an address on behalf of that section by Mr. J. G. Jones on the subject of

SELLING THE INTANGIBLE

J. G. Jones, Vice-President, Alexander Hamilton Institute, New York, N. Y.

Mr. Chairman, ladies and gentlemen, it is a pleasure to be with you this morning. Men who are keeping their eyes open on business of whatsoever nature realize that, wherever an industry is found, the only way it can prosper generally, and get the utmost good-will locally and nationally, is by a close cooperative association.

It seems to me that the American Gas Association is a remarkable factor in the development and growth, not only of the gas industry itself, together with its allied industries, but it is also a big power in getting the organization more closely welded.

The subject that was given me to talk on, "Selling the Intangible," can well be divided into three heads: First, selling the intangible to the members of the industry; second, selling the intangible to the public; and third, the selling of the intangible to the individual user of your product or products.

Now, it seems to me that the success of a campaign of selling the intangible to the public and to the consumer is absolutely dependent upon how closely knit you as an organization or as organizations are. There are over 900 producers of gas, gas companies, and, out of that 900 or more, I believe you have a membership in the American Gas Association of something like 460 or 480. It seems to me that that is not such a good record in spite of the fact that your membership does represent 90 per cent of the output of your industry.

You are one of the oldest of all the public service industries, more than a hundred years old, and today you have 400 members of the industry who are not cooperating with you in the selling of the intangible to the public. You might say that a 10 per cent failure is not so bad. Ask some of your committees how bad it is when they have to go down before a committee in Washington, a finance committee or a fuel committee, and they are asked if the entire industry is represented in the appeal. I claim that a failure to get the membership up to 100 per cent is a failure of the membership of this Association itself.

The intangible that you are selling to the American people must first of all be sold to your own industry. You know how the work has been done in various cities. You know that the welfare committees and the publicity of your membership, perhaps through your Association, perhaps not, that work is building up an enormous good-will. Good-will can hardly be called local; good-will for any industry, for any product, must become 100% or even 80%; but, it must be a national good-will. And these 400 members of your gas industry, who are not cooperating with you in your work of selling the intangible to the public, are a menace to your industry.

There never has been a time in the history of the industry when big business had more problems to solve than at the present time. There seems to be a psychology—not only in Europe, but in every country of the world—a psychology of dissatisfaction against things as they are. There has always been criticism of the public service corporation. There has always been dissatisfaction evinced against the services of corporations that are directly serving the public.

The time may have been when there was real reason why the users of the products of public service corporations, whether it was gas, street car service, railroad service, or electric light service—there may have been a time when dissatisfaction had some cause, some basis, but today I believe—and I have made the most careful analysis and investigation of the workings and of the operations of the gas industry and its associated industries—and I have been amazed to find that you men are extending every effort based upon a great deal of thought, based upon a great deal of cooperation, in bringing the public to a better understanding of your attitude towards them.

It is very hard to educate the public to an understanding that their best interests must be the best interests of the corporation supplying the service in question. So I say the first step in selling the intangible is to get every man, every corporation in the gas industry, into your Association. There is nothing that tells as much as cooperative effort applied under close supervision.

All of you separately in your various territories and fields could accomplish but little, and the fact that you are here today in convention gathered is a clear demonstration of the success of this big cooperative movement of yours.

Perhaps my biggest piece of advice this morning—I do not know that you are looking for advice, but as an outsider I can give you advice on your biggest weakness—is that every member of this Association make it a personal business to go back, and, if you find any single manufacturer of gas or of gas appliances who is not sold on the big idea of the American Gas Association and its services to the industry as a whole and to the individual, whether corporations or partnerships, sell them the intangible and show them that you actually do get something out of this connection, because unless you have sold that one intangible idea of service and cooperation to all of your industry, you are going to fall short of carrying out the responsibilities of selling the intangible to the people whom you are serving.

The selling of the intangible—well, the average user of gas never gives it a thought. She turns the gas on; strikes the light to it; lets it burn, and turns it out when its work is finished, and gives no thought to the service that she is getting from your product.

The housewife may say in connection with a new stove or a new appliance: "This is a wonderful appliance," but she hardly connects that tangible appliance with that intangible something without which that gas stove or gas appliance would be of no use whatever.

You know, it is amazing that although gas has been in use in the United States for a century and that there is no community of any size or importance whatever in the United States without its gas utility, it is still true that the average woman, or the average man, does not connect the big investment back of this industry, the terrific amount of business planning, the terrific overhead and ex-

pense. It is absolutely true that the public, not only as a whole, but very few individuals within houses where your product is used, rarely actually visualize the product that you are selling to them.

Then, of course, the meter day comes around—the reading of the meter—and there is dissatisfaction. It is not as it used to be five, ten, fifteen years ago, but still one of your biggest problems in the industry today is the dissatisfaction with the bills because there has not been a keen and full realization of the amount of your product that has been used. There has been no thought given to the actual service that your product has delivered to the user and that is because it is intangible.

People who use coal know when the bin is empty; they know when they have to put in one, five, ten or fifteen tons of coal, and as the prices keep mounting there is not the same complaint when the price of a ton of coal will go up fifty cents or a dollar that there is when the gas bill goes up a few cents in any given period, because, they see the coal; they have to put in labor in the handling of it. But with your product, that intangible product that does not become visible until it is lighted and has the chemical structure to give them the visualization—not until then do they realize that they have actually gotten at home, waiting to work for them, a servant that is never asleep, a servant always ready to do its best. Not until the gas bill comes do they give it a thought and when that comes, I am afraid in a great many instances, the thoughts are not productive of harmony and good will.

That is another side of the intangible. And the third side of the intangible is the selling of your services, the public service corporation and its allied industries, selling it to the public as a whole. You know man is a gregarious creature and if you can only get men to think in mass, men and women to think in mass, you are accomplishing something that is most marvelous.

When you get a community to think in a mass along constructive, affirmative lines, you are then creating for your industry, for your business, a good-will, a mass good-will, and I want to say to you that wherever you have that kind of a creation, a mass good-will, it is not such a long way to the final education of the individual using your product.

I do not know why it is so but it is, and you know it; the public service corporation is ever under fire. And I believe that the reason for that, in the past especially, has been due to the fact that public service corporations have not only been too willing to take their medicine lying down but they have not been willing enough to tell the public the good things about their industry.

You know, the intangible is a peculiar thing, whether it is good or bad. You can let a few newspapers or a few speakers who get the ear of the public say bad things about any industry and immediately there comes an opposition to that industry, and you will find it wherever that news has permeated.

As a rule the public is more prone to listen to criticism than it is to praise. It is a fact. That is the psychology of the public. I am afraid, as individuals, we stretch out our ears when something unpleasant is said, even about an individual. And the big problem we have got today in our community, within our nation, in our own organization, is to make people think affirmatively and to think good thoughts. And that is not Christian Science; it is religion, yes, because true

religion, true manhood, is that ability to at all times think the best of the individual, of his business, and of national problems. That is your problem in the selling of the intangible.

Now, how can that be done? Well, it is not possible and a meeting of this kind does not result in wonderful results. I am sure that each and every one of you, as you get back to your home organization, take with you that undefinable something that is stronger after your visit to this convention than it was when you came here. That is that desire for cooperation, that desire to make the industry stand foremost among the public service industries of the United States. You go back with a great feeling of pride in the attainments of the past and a more decided and definite purpose in the solution of the problems of the future. And as you tell the story of the convention and of the new sidelights you have gotten on the importance and the dignity of your business, that is passed down to the entire organization.

An organization after all is but the reflection of the man at the top. If the man at the top is keenly anxious to increase the good-will of his corporation, of his industry, then that feeling is permeated through the entire organization. Yes, publicity does wonderful work, but after all it is by their acts that you shall know them, and if the collector of the gas bill is not so absolutely impregnated with the idea of service and dignity and kindness and love, then all the advertising that you do in the daily press will not get you anywhere.

If the man who is putting in the gas appliance, the new stove, is not thoroughly sold on the idea that his business is inseparable from the gas business and that it is just as much his business to sell the idea of the fuel that is used in that stove as it is to make a good impression with the stove itself, you are not functioning 100 per cent. And if every gas man, whether he is a meter reader or a bill collector or the president of the company, does not believe in spreading the psychology of the close cooperation between the gas appliances and the gas itself, then he is not getting the best out of his business and the most out of the public, based upon a desire to serve the public in the best possible way.

Yours is an industry that will never die. It will be bigger next year than it is this, and in twenty years from now you will practically have doubled, because you are not only serving the individuals in their homes but I firmly believe that industry itself, the big manufacturing plants, are more and more coming to your way of looking at it and are going to use the heat units from the mains of the gas companies of the United States of America.

Now, any good will that you have with the public carries right through into the industry. I have known of industries where the workers complained when gas was installed. You know of them, too—around the Pittsburgh district, etc. And it has even taken good propaganda to sell communities upon something that is worthwhile. When we say propaganda, as a rule, we think in negative terms, but after all propaganda, the right kind of publicity, and that is all it is, tied up with the user will bring the results. And do not forget that the biggest problem you have is putting your customer in the picture. There is not a single piece of advertising that is worth the paper it is printed on if it is not dealing with the individual problem of the consumer.

Yes, you must educate them along lines of your problem. After all, the public is fairly reasonable if the proposition is put up squarely to it. But you must talk to the public just the same as you talk to children, do not forget that. The simpler the language, the simpler the message, the easier it is to get across. And if you can show the public, by keeping the public in the picture, that your problems are problems of getting the coal, of getting transportation, of getting the oil, of getting your pipes down under the city streets, of keeping the pipes open, of keeping the continual flow at the peak of the day—if you can give the public to understand your problems while showing them that they—he—she—the individual, after all, is the big aim of your entire organization, you are then selling the intangible, and the intangible is that good will that will kill unfair legislation.

Once you have got the public sold that you are actually sincere—and there is no question about it in my mind—it is good business to give good service. Once you have got the public sold, that fool legislation, whether it is in Pittsburgh, Chicago or Washington, will be pretty hard to put across. Just get the public sold on the fairness of the manufacture of gas and the manufacture of the allied industries, and selling the intangible is not nearly as difficult as it seems. But you must have close cooperation. There can be no members of the industry who are pulling the other way and not pulling with you in your common purpose.

Once you have sold your own organization a hundred per cent, then it becomes easier to sell the public 100 per cent. And by selling the public 100 per cent you will eliminate that old sore on the gas bill and you will have your customers convinced that, though gas is absolutely intangible as far as sight and feeling is concerned, it is one of the most powerful servants, one of the most useful servants, one of the most indispensable servants, that has been given to the human race.

Sell the intangible. The good will that you get, will more than compensate you for all the sacrifices you have made in attending committee meetings and conventions—if it is a sacrifice to come to Atlantic City and enjoy the beautiful sun and air and go to the golf courses, as I saw a lot of them doing this morning. Sell that good will, ladies and gentlemen, and the time will come when the public will feel just as you do, that you have got one of the greatest businesses in America and that you are only getting what you deserve out of that business because your ideas and your ideals are service.

F. A. Lemke: Mr. Jones, in behalf of the Manufacturers' Section and the Association, I wish to thank you for your most interesting address.

The president then invited Mr. William Gould, chairman of the Commercial Section, to occupy the chair during the presentation of an address on behalf of that section by Mr. P. S. Young on the subject:

SALES DEVELOPMENT AND ITS RELATION TO THE GAS BUSINESS

P. S. Young, Vice-President, Public Service Gas Company, Newark, New Jersey

In almost all competitive business the development of a market is of prime importance, in fact the success of such enterprises to a great measure depends upon the intelligence and energy devoted to market development.

Is it not worth while therefore to consider the benefit to be obtained from efforts devoted to the extension of the market for the product of the more or less non-competitive gas industry? Can we not gain instruction by studying the conduct of other industries whose very life proceeds from the keen struggle to survive in the economic race?

Everything we enjoy today rests on an economic foundation. The only sure foundation for the gas industry is an economic one. Economic principles require production and distribution without waste. Every energy of modern business is directed to produce at the lowest possible cost and to distribute and sell to the widest possible market. There can be no question that this is the right course. The profit to be obtained is the reward sought for and the penalty is the same if this course is not pursued by the gas industry or by the competitive producer, only perhaps it is not apparent quite so soon in the case of the utility, but in both cases it means loss to the investor and to the community.

The problems of production and distribution of gas require the highest engineering and financial talent, wide knowledge of the market for raw materials and broad experience in the handling of materials and direction of men. With all these available, however, policies embracing sales development must be established to enable these to operate at the highest efficiency.

There are certain fundamental differences between a natural monopoly, such as the gas business, and other industries. In the first place, the gas industry is restricted in its market, its capital is not susceptible to easy conversion to other uses, its annual gross earnings are a fraction of its invested capital; the gas utility that turns over its capital once in three years is indeed fortunate. There are other differences which follow in the wake of the principle of regulation to which it is subject, such as restrictions as to product and price. These differences, however, are not so fundamental, for while the product and prices of utilities are fixed by an official body for the consumer the product and prices of the competitive industries are fixed in large measure by the consumer. The competitive industry is a much freer instrumentality. A large part of its capital is liquid, and it can change its product, find new markets and convert its capital to other

uses without undue loss. There is no outside limitation to profits or losses and self-interest keeps it eternally vigilant in the development of its business. It receives no protection and it asks for none, it is responsible to its owners only, though those industries that have recognized the widest responsibilities are those that have been the most successful. The responsibility of the gas utility is an enforced one, yet here, too, the utilities that have accepted the widest responsibilities are, generally speaking, also the most successful. Responsibility for good service, for efficient operation, for wise and statesmanlike policies, for cultivation of the good will of the public, encouragement and training of the personnel, intensive development of the use of gas, adequate expansion of plant and extension of service—all of these are required for a proper development of the market for gas in any community.

It is undoubtedly true that the type of regulation which gives the widest play for the operation of economic forces and furnishes the necessary incentive for efficient operation and greatest development is much to be desired. Such a type of regulation is a matter of education not only through experience on the part of regulatory bodies but by education of the public as to what is conducive to its best interests. In the final analysis in a democratic government we find the correct determination of these policies depends upon the education of the individual voter. It is beyond the power of one utility or even a few utilities to affect or change public opinion. All utilities must co-operate to this end.

It is encouraging to note that several commissions are recognizing the importance of incentive to human action and the wisdom of encouraging efficiency and enterprise in utility operation. The following are excerpts from decisions of Utility Commissions:

Decision by Illinois Public Utilities Commission Re. Complaint relative to electric rates and water rates; City of Lincoln v. Lincoln Water & Light Company; November 28, 1916.

"Whether or not a utility, in past operations, has fulfilled its duty toward the public, in rendering service in an adequate and efficient manner by keeping abreast of scientific and economic development, and whether or not it has rendered service of suitable quality to its consumers and conducted its business with a view of giving to its patrons full opportunity to utilize electric and water service to advantage, are matters to be considered, with other evidence in reaching a decision as to a proper rate of return. A utility which is excellently managed, progresive in development, alive to the public requirements, aggressive in securing new business, economical in operation, courteous to consumers, and fundamentally honest in all transactions, should receive greater consideration in the fixing of a fair rate of return than should a utility of which the reverse is true."

Decision of Illinois Public Utilities Commission Re. Petition for advance in rates for Electric Service by Little York Electric Company; November 6, 1917.

".....It has been contrary to the policy of the Commission to determine upon an arbitrary rate of return to be allowed in all cases coming to its attention; since to do so would offer no incentive for economical and efficient operation, but would rather tend to discourage utility operators from exercising good business judgment in the conduct of their business."

Decision by Illinois Public Utilities Commission Re. Application by Monmouth Public Service Company for leave to establish increased gas rates; January 23, 1918.

"(3, 4) It may be conceded that petitioner is entitled to a reasonable return upon the fair value of the property devoted to the public service. What this fair return may be will vary under different circumstances, and will depend upon local financial conditions, the hazards connected with the business, the nature of the service, and other factors of more or less importance in specific cases. This Commission has heretofore taken the position that financial rewards in public utility enterprises should be commensurate with the ability displayed in their management; to assume that mediocre stewardship is entitled to the same rewards as capable conduct of affairs

is to enunciate a doctrine at variance with the sum of human experience and with principles well recognized in the business world."

Decision by Massachusetts Public Service Commission Re. notice of The Union Street Railway Company of proposed elimination of certain transfers on its railway; June 6, 1919.

"The Commission has also frequently expressed the view that the rate of return should not be uniform for all companies, but should be measured in each case by the efficiency of the management and the character of the service rendered. On that basis the Union Company, whose record of successful street railway operation is unique in the history of the state, might fairly be entitled to reap the reward of its enterprise and sagacity by being permitted to earn more than the normal rate of return."

Decision by Illinois Public Utilities Commission Re. Application for increase in rates for electric service by Monmouth Public Service Company; June 16, 1919.

"(2) It appears from the testimony introduced that the electric service rendered by the petitioner in Monmouth is satisfactory. It also appears that the electric utility is operated in an efficient and able manner, with a view to securing as low costs of production as possible. The petitioner contends that operation of this nature should be rewarded, and the Commission is fully in accord with this theory. It would obviously be improper to base the rates for utilities service upon a hard and fast rule of the actual expenses of operation and fixed rates of return without regard to the efficiency displayed in the conduct of the business. Such a procedure would offer no incentive for improvement and no reward for accomplishment. The public has the right to expect efficiency of operation of utilities engaged in public service and has the right to share in its benefits, but accomplishment merits a tangible and genuine compensation for its achievements."

Decision by Illinois Public Utilities Commission Re. Investigation of proposed increase of rates by Champaign & Urbana Water Company; July 8, 1919.

"Besides the cost of money, which varies with the prices of other commodities, it appears reasonable to reward superior management of a public utility enterprise in proportion to results achieved, a proposition based upon sound business principles and economic laws. This principle has heretofore been recognized by the Commission."

Decision by West Virginia Public Service Commission Re. Application by United Fuel Gas Company for authority to increase rates; December 19, 1919.

"(9) Extraordinary skill and judgment in location and construction of plant, and economical, efficient operation and management and superior service must be rewarded, as lack of such must be penalized, in the rate of return. Two utilities having the same investment cost and the same gross income and engaged in the same business, may be entitled to widely divergent rates of return by reason of the existence or non-existence of the very elements above mentioned. We have also recognized the diminished value of any given rate of return measured by its purchasing power in other commodities."

Decision by Maine Public Utilities Commission Re. Application by Lewiston Gas Light Company for increase in gas rates; October 28, 1920.

"Our investigation shows thtat this company is exceptionally well managed. In the matter of unaccounted-for gas, where the average for companies throughout New England is from 10 to 14 per cent and several companies within this state are about 17 per cent, the Lewiston Gas Light Company's unaccounted-for gas is but little more than 6 per cent. The salaries paid are reasonable, our analysis of the operating costs of the company shows no opportunity for greater economies, and we are forced to the conclusion that, however unpopular an increase may be, fairness to the customer and to the company requires an increase which will very nearly absorb the increased cost of operation due to the increase in the price of coal and oil and some other materials."

Decision of Indiana Public Service Commission Re. Petition for authority to put into effect a revised schedule for hot water heating in the City of Elwood, Indiana, by Indiana General Service Company, November 5, 1920.

"(1, 2) A utility which is operated efficiently, as this one appears to be, and which is giving good service, should be allowed a higher return than one which is giving poor service through bad methods of operation. Its initiative and its successful efforts to furnish good service at a minimum cost to its patrons should be recognized and encouraged by a higher rate of return than would otherwise be justified."

Decision by Indiana Public Service Commission Re. Petition by Illinois Bell Telephone Company for authority to increase and readjust rates for service; March 29, 1921.

"This utility is entitled, under the law, to earn sufficient revenue to meet its necessary operating expense and pay a reasonable re-

turn on the value of its property. This it has not been able to do for several years with the rates it has had in effect. An increase might be denied, however, if there was evidence of incompetent management, excessive expenditures, or bad service. The evidence, on the contrary, shows that the management is highly efficient, that the business is conducted with the most rigid economy and that the service is adequate. Under the circumstances, as disclosed by the evidence, the Commission has no choice under the law but to increase the rates."

Decision of Ohio Public Utilities Commission Re. Application for increased telephone rates, City of Lima v. Lima Telephone & Telegraph Company, November 18, 1921.

"(4) We believe, and it is our judgment, that honest, economical and efficient administration of the affairs of a public utility should be commended by us, and should be considered in deciding the amount of a fair rate of return upon the company's property, since to hold otherwise would be but to penalize economical, efficient and honest management, and encourage extravagance and lax methods in the management thereof; and, in the instant case, we are more than satisfied that the Lima Company's affairs have been honestly, economically, and efficiently administered, and, in arriving at our conclusions herein, have given due consideration to those facts."

Decision of New Hampshire Public Service Commission Re. Investigation of proposed increase in electric rates, Franklin Light & Power Company, November 30, 1921.

"(5, 6) In fixing the amount of return, due allowance must be made for efficient and economical management. The keen and energetic utility owner who by good judgment, foresight, and approved business methods reduces his plant investment and operating costs to a minimum should be allowed a larger percentage of return than the utility owner who through lack of ability or indifference furnishes service at a much higher cost. It must always be borne in mind that the rate of return allowed must be such that new money shall be available for extensions of the plant to meet the increases in the needs and demands of the public."

Decision of North Dakota Board of Railroad Commissioners Re. Application by Dakota Utilities Company for authority to continue in effect present temporary electric rates; February 24, 1922.

"(4) The Commission does not believe that a utility that is uneconomically operated is entitled to earn as large a rate of return upon its investment as one which is economically and efficiently operated. This Commission has previously held that a reasonable rate of return varies with conditions under which the property is operated. Courts have so held. If the Commission allows the same rate of return to a company which is economically and efficiently operated as it does to one which is uneconomically operated, we would be placing a premium upon the latter and there would be no inducement to practice economy."

Decision of Idaho Public Utilities Commission Re. Application of Boise Street Car Company for authority to increase street railway fares; February 25, 1922.

"...It must not only initiate and put into effect all reasonable economies and efficiencies, but it must also go after business; and proof of such activities will be regarded by us as essential before the step of a substantial raise in rates will be taken."

Decision by Michigan Public Utilities Commission Re. Joint Application by City of Grand Rapids and the Grand Rapids Gas Light Company praying the Commission to assume the regulation of gas rates, and rules and conditions of service; February 28, 1923.

"The Commission believes it proper to base its rate of return in some degree upon the economy and efficiency with which the utility in question serves the public.

"The owners of a utility who are alert and active at all times in an endeavor to serve their public at the lowest possible, reasonable cost are entitled to be compensated for their efforts. The amount of money going to the owners of a utility by way of return upon the fair value of the property used and useful in serving the public is ordinarily rather a small proportion of the total amount the patrons of the utility are required to pay. By far the greater amount the public is required to pay is used up in operating expense, taxes, and the maintenance of the property. Where the owners of a utility make use of every reasonable economy that will keep the operating expenses at the lowest possible reasonable figure they can and should be granted a greater rate of return than they should receive where these efforts are not made. Assume two gas utilities existing under practically the same conditions; one of them through up-to-date methods is able to furnish gas to the public at a given price, while it costs the other 10 cents per M cubic feet more than it costs the first one. Should the owners of each utility receive the same rate of return? The Commission thinks not. Enterprise, economy and efficiency should receive some reward. The only means by which the owners of a utility can be compensated for their enterprise, efficiency and economy is through the rate of return."

Decision by Maryland Public Service Commission Re. Application by Consolidated

Gas, Electric Light & Power Company of Baltimore for increase in primary gas rate; June 12, 1923.

"Insofar as the increased earnings due are to business foresight and managerial skill, we feel that the Company should have some share in the savings so effected. Otherwise, regulation may destroy that incentive to economy and enterprise which the absence of competition in the utility field renders difficult to preserve."

Decision of Public Service Commission of Pennsylvania, Re. reasonableness of rates charged by Philadelphia Rapid Transit Company; June 21, 1923.

"Perhaps the most important single consideration which it is our duty to weigh in the determination of reasonable rates, is the paramount public need of increasing and improving service. Undoubtedly there has in past years been serious criticism of the retrenchment policy of the respondent company, and for the decade preceding the inauguration of this case there was little evidence of any tendency toward expansion. A marked change has come about since the establishment by us of the fares now in effect. Not only does the record show that the service furnished through existing facilities has been increased during the last two years at a substantially faster rate than increased riding, but what is of more importance, the company has undertaken and carried out the operation of the City-built elevated railway to Frankford, involving an operating loss.......

"The record also discloses plans for further and continued improvement and expansion involving several additional street railway lines supplemented by busses and trackless trolleys.

"No consideration of a public question of this importance that did not look into the future, would be complete or satisfactory and the future holds for Philadelphia some tremendous problems for the expansion of its transportation facilities and the building and operation of high speed lines. If we are to take cognizance of negotiations now being conducted by the municipality and the respondent company, the city is contemplating the expenditure in this direction of more than $100,000,000 and is negotiating with the company in an attempt to find a basis under which the company would undertake the operation of those lines when built, on the theory that the public convenience will be best served by a unified operation of the entire transportation system.

"Recognizing the growth of Philadelphia, desiring in every way to aid in the solution of its difficult transportation problems, and wishing within the limits of its powers to give to the citizens of Philadelphia the best transportation facilities in the country, this Commission would indeed, be reluctant at such a time, to make any order, that would impair the financial strength of the company upon which devolves so great a portion of this task, unless impelled thereto by the paramount interests and rights of the car rider.

"In support of a policy of permitting the company a substantial or even a generous revenue, one particular provision of the Public Service Company Law has been urged. Article III, Section 1 (a) gives to every public service company the right

> 'to participate, to such an extent as may be permitted by the Commission, and deemed by the Commission wise, for the purpose of encouraging economies, efficiencies or improvements in methods of service, in the additional profits which will be afforded by such economies, efficiencies, or improvements in methods of service.'

"Presenting to us its claim to share in results achieved under this section, the company has offered voluminous testimony relating to economies and efficiencies in operation and improvement in services which it claims to have made effective in recent years. The City does not dispute the presence of notable economy and efficiency in the operation of the respondent system as the following quotation from paragraph ten of the report of the City's engineer shows:

> 'That there is first class co-operation between men and management on the Philadelphia Rapid Transit property is freely admitted. This co-operation no doubt results in more economical and efficient service to the end that the men, the stockholders and the public all benefit thereby. This co-operation is producing certain beneficial results.... The demonstration of the work done by the Philadelphia Rapid Transit Company, looking toward accident prevention for children, is very impressive, and there is no doubt but that the Philadelphia Rapid Transit Company is in the front rank in this splendid work.... Reviewing the list of efficiencies claimed for supermanagement, the accident prevention work and the co-operation, particularly on the part of the trainmen, deserve recognition.'

"Surely no stronger case can be presented covering the contingency in which the legislature has directed the Commission to give consideration. The Commission is of the opinion that the company has established the existence of economies and efficiencies in its operation and is entitled to share in the results thereof.......

Conclusions

"2. With regard to operating expenses we are not disposed to interfere with the budget submitted by the company as long as it continues its present policy of improved service and a high standard of maintenance.

"3. In this connection we are of opinion that the company has established its right to share in additional profits resulting from approved economies and efficiencies in its operation."

The following are taken from recent cases before the courts:

Opinion of New Jersey Supreme Court Re. New Jersey Central Traction Company v. Board of Public Utility Commissioners, May 5, 1921.

"(1) The fundamental question upon which the case turns is whether the Board may, in determining what is a just and reasonable rate of fare, take into consideration the safety, sufficiency and adequacy of service. The contention on behalf of the prosecutor is that the Board cannot. The plain reading of the statute and a consideration of universally recognized business principles adopted by the commercial world and which are basic of our state policy lead me to the view that, in determining whether a rate of fare proposed by a public utility is unjust and unreasonable, the Board may properly take into consideration the safety, sufficiency and adequacy of the service rendered."

Opinion of United States Supreme Court Re. Bluefield Water Works & Improvement Co. v. Public Service Commission of West Virginia; June 11, 1923.

"The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties. ...."

Minority opinion written by Mr. Justice Brandeis and concurred in by Mr. Justice Holmes; United States Supreme Court; Missouri ex rel Southwestern Bell Telephone Company v. Public Service Commission of Missouri; May 21, 1923.

"Capital charges cover the allowance, by way of interest, for use of capital, whatever the nature of the security issued therefor; the allowance for risk incurred; and enough more to attract capital. The reasonable rate to be prescribed by a commission may allow an efficiently managed Utility much more."

The average individual is impressed by acts more than by words and will be overwhelmingly influenced by his personal experience with a utility. It is all the more important, therefore, that the policies laid out and followed should be such as to convince him that his interest is being served properly by the particular utility with which he comes in contact.

During the war the war activities caused the practical abandonment by gas companies of all business development and later, the post war readjustments, which brought about high rates for money and very much higher construction costs as well as lower net income of gas companies, caused such a shifting of conditions that it was impossible to plan permanent programs for business development. It is also true that most managements were visited with so many difficult problems during this period requiring immediate consideration that plans for business development could receive but scant attention. Many of these difficulties have now been overcome and the times call for constructive work in this connection.

There is a pressing need at this time for the employment of those functions and activities which will create the best impression upon the average consumer and give the right foundation for the efficient operation of a successful enterprise. The establishment of a strong and efficient commercial organization in each gas situation is imperative. Its function should be the establishment of good relations with the consumer; the development of a wider market for gas; the employment and training of experts on whom the consumer could rely for advice on the utilization of gas for industrial fuel and other purposes; the conduct of home economics service work; proper marketing of appliances, proper advertising methods and all the other functions that are so well performed by such departments in the more efficient companies. The direct effect of the proper development of these

functions and activities will be found in larger sales and lower costs, but the indirect effect will be immeasurable. It is strongly urged that the men employed in such departments should be encouraged to take part in the determination of the policies which control the operation of the company. These men represent in large measure the personification of the company in the eyes of the consumer. Their attitude and their personality portray to the consumer the indefinite entity which he terms the Gas Company. If the relation they establish is a right one the company will benefit. If it is a wrong one the company will suffer. Generally speaking, the community is proud of its prosperous enterprises. The Gas company that is highly regarded in the community because of the character of its service, personnel of its employees, wisdom of its policies, and enterprise of its management will receive the support of the community in any proper undertaking and is likely to receive generous consideration and encouragement in the way of return upon its investment.

The sale of securities to customers can very properly be delegated or promoted through these men who come in daily contact with the customer. The wisdom of such a course has undoubtedly been proven. The community should be relied upon to furnish a considerable part of the funds for extensions and betterments and expansion of the property serving it.

A well managed and competent selling organization will frequently be found to be the last to recommend reduction in rates, reduction in prices of appliances and other concessions that are merely expedient in their nature. It recognizes the value of the Company's product, the necessity for a fair price and the desirability of the product being sold at its economic value. It must prove a reliance in the consideration of rate adjustments and has a wide field in the development of unprofitable consumers to profitable consumers. The success of such an organization is so closely related to service in other departments that a stimulating revision of service standards is bound to take place with its installation.

There are no doubt great economic changes to be expected in the next few years. It is the duty of the gas industry to look ahead and prepare itself for these changes. There has been created by the recent economic changes a greatly increased purchasing power among the largest part of our consumers. There also has been created a demand for convenience to offset the effect of increased cost of domestic and other service on another large class of consumers. Full advantage can only be taken of these changes where there is a permanent force whose constant study these changes are. The safety of the enormous investment in manufacturing and distribution plant of gas companies calls for the fullest possible utilization of these facilities. It is of course recognized that it is not sufficient for a gas company to be following the right policy, to be progressive in its management, efficient in its operation and resourceful in its activities, and that the full benefit of these are not obtained unless they are widely known. The facts pertaining to the company should be widely disseminated and properly placed before the public through the use of newspaper space, communications to customers, and addresses before public bodies. The Company's plants should be open to inspection and the public invited to visit them. The Company's offices and sales rooms should be well

located, properly manned and attractively arranged. The company's officers and employees should take part in the affairs of the community and establish the widest and best contacts in an endeavor to promote the best interest of the community in every way. The effect upon the financial and general credit of the company, of the regard in which the company is held in the community cannot be overstressed. It is necessary to have the company enjoy such credit in the first place to get the necessary capital and in the second place to get such capital at the best possible rate. The efficiency of the company is so largely dependent upon its ability to raise capital that the credit conditions surrounding the company are of the greatest importance.

The service rendered to customers should be of the highest character. All customers' orders should be attended to promptly and the execution thereof both as to methods and workmanship should be such as to elicit the favorable comment of the customers.

Customers' equipment should be periodically inspected and kept in highest state of efficiency. This necessarily forestalls complaints through insuring customers' satisfaction with the product.

The utility company should offer to its customers the newest and best gas burning appliances obtainable and at a resale price that is fair alike to the customers, the utility and the other appliance dealers. Such a policy protects the utility company by providing means for maximum distribution of properly designed appliances to its customers.

There should be a greater development of the industrial fuel business. As there is a great shortage of men with sufficient knowledge of the business to take care of its proper development, it is suggested that the Association arrange classes, similar to the classes which were conducted by the Massachusetts Institute of Technology recently, in various parts of the country. This would enable the gas companies in the immediate vicinity of the cities in which these classes are established, to obtain the benefit of this instruction. Companies should be urged to send as many men as possible to attend such classes.

The Rate Structure Committee of the Association has made a number of studies on the rate question. Gas companies as a general rule, have, with very few exceptions, no scientific rates based on demand applicable to wholesale and industrial business. This is especially so with the smaller companies. This matter should receive greater consideration.

In regard to the use of gas for house heating, there seems to be a great difference of opinion as to whether it is profitable for the gas companies to push this business. The Association should undertake to determine whether it is advisable to go after this business. Gas Companies should push to a greater extent the heat regulated gas range which would put it on a par in this respect with the automatically controlled electric range.

More attention should be given to the development of domestic science departments. The employment of well educated women is suggested, preferably graduates of domestic science schools, who are qualified to speak to womens' clubs and schools on the use of the better grade of appliances, such as, the heat regulator ranges, storage water heaters, gas bathroom heaters and radi-

antfires. These women would be of great help in broadening the market for gas and incidentally in fostering better relations between customers and the company.

This fostering of proper relations in each community is of such great importance to the industry at large and to each indivdual gas utility that I want to urge earnestly upon the Association consideration of a plan to bring about the adoption of the policies and measures I have indicated or the adoption of such other policies and measures as are calculated to have a profound influence in building up the industry.

Perhaps the formation of a Commercial Policy Committee by the Commercial Section to make from time to time suggestions and recommendations to the Association concerning these matters would prove to be to the advantage of the industry. I believe such a committee would have a direct and heartening influence and bring about results which could be accomplished in no other way. The gas business seems to be at the beginning of a new era of development and wider sphere of usefulness and such a committee should be able to point plainly to the road of opportunity.

Wm. Gould: I want to thank Mr. Young for his valuable contribution this morning, thank him personally, as well as for the Commercial Section.

THIRD SESSION

Thursday Morning, October 18, 1923.

The meeting was called to order by the president at ten a. m., the first order of business being a consolidated report of general committees, presented by the secretary-manager. At the conclusion of the reading of the consolidated report, on motion, seconded and carried, the reports of the general committees covered in this report were accepted, approved, and ordered to be printed complete in the proceedings.

(The complete reports, abstracted in the consolidated report, follow):

RATE FUNDAMENTALS

R. A. Carter, *Chairman,* New York, N. Y.

The past year has been a period of continued progress in the clarification of the law as to the right of public utility investors to receive effective judicial protection from confiscatory statutes and rate regulations. Several important decisions of the United States Supreme Court and of various state courts have given added vitality to the constitutional guaranties and have marked progress in resolving some of the controversial questions as to the bases of the valuation of public utility property.

Perhaps more fully than ever before, the past year has brought home to the investors in and managers of public service enterprises, a realization of the far-reaching importance of valuation questions. The constitutional assurance that private property may not be taken for or devoted to public uses without just compensation becomes illusory and ineffectual, unless the constitutional guaranty carries assurance that the value of such property will be determined at an adequate sum, and that the owners will be allowed to earn an adequate return upon such value. Before the courts and regulatory commissions of the country, in the litigation involving the valuation and earning power of public utility projects, there is being fought out the vital issue whether private property and private enterprise still have rights which political agitators are bound to respect. The fundamental importance of these valuation questions to all public utility investors has been recognized during the past year as never before; and the industry has escaped the

danger, which once menaced it, through treating these valuation questions casually and permitting them to be decided adversely because of inadequate presentation.

The past year has witnessed progress in another aspect of the situation. There is developing a greater sense of unity, common interest, and cooperation, between the different groups of public service enterprises, in the handling of these valuation questions. Heretofore, each group has seemed to think it could serve its own interests best by "playing a lone hand" on these questions. The steam railroads, the telephone companies, the power and lighting group, and even the gas industry, have each been inclined to feel that their own problems and interests were unique, different and apart from those of other public service enterprises. Valuation questions in each industry were therefore dealt with in a separate and detached way, and divergences of contention and policies developed which have proved harmful to the common interest.

Now it is coming to be realized that the bases of valuation of property devoted to the public service constitute a problem common to all public service industries, and that the interests of one industry are the interests of all. Rules and principles of valuation determined in railroad or telephone cases become the controlling precedents in gas and electric rate cases, and *vice versa*. A sound ruling in any railroad or public utility case is of common benefit to all investors in public service enterprises; and an unsound ruling, due to inadequate preparation or presentation or to some fancied local exigency, becomes a common menace to every investor throughout the country. Every unsound decision, in any state, or as to any company, has infinite potentialities of general harm. Each public utility company, its executives and counsel, are thus the custodians of the interests of the entire industry during this formative stage of the law.

During the past year, the foundations have been soundly laid for a great deal of salutary cooperation along these lines, and better team-work may confidently be expected, in the years immediately ahead. This is a most opportune development, because a crucial stage has been reached in the determination of the fundamentals of the valuation of private property devoted to the public use. Controversial issues long held in abeyance by the courts and by the Interstate Commerce Commission now press squarely for a decision which cannot longer be delayed or avoided. The whole future of private investment in public service enterprises, and so of continued private ownership and operation of these enterprises, depends on the decisions which are just ahead.

The decision of the United States Supreme Court in the *Southwestern Bell Telephone Company* case, and in several of the decisions which followed it, gave promise of constructive and broadminded approach to the more detailed questions which press for adjudication. If coupled with rulings economically sound as to the rate of return and as to the agitators' claims for large deductions for speculative and non-existent elements, the Supreme Court's adherence to the concept of present value will place the utility industries of the country on a basis enabling them to extend and improve their service to an extent impossible under the conditions of the past decade. On the other hand, some regulatory bodies

have tentatively adopted bases of valuation which, if persisted in by the commission and sustained by the courts, would imperil the security of every public utility investment in the United States.

The work of your committee, along lines of comprehensive statement and clarification of rate fundamentals, cannot be brought to completion until decisions have been rendered upon many of the mooted questions, involved in cases now on their way to final adjudication. It has been the privilege of your committee from time to time to render aid and counsel to member companies, along lines of seeing to it that the issues in some of these cases were soundly developed and adequately supported in the evidence.

Your committee has made some progress in the formation of a report embodying a summarized statement or syllabus, which may be of aid to member companies in clarification of the sound fundamentals of the subject. This comprehensive report we shall hope to submit to the Executive Board of the Association before the next annual meeting, and to the Association itself at that meeting.

Constructive work along similar lines is being undertaken by public-spirited organizations, notably by the Council on Public Utility Law of the American Bar Association and possibly later by the newly-organized American Law Institute. The activity and aid of such expert and disinterested collaboraters in this field is, of course, most gratifying.

Recommendations

We respectfully recommend:

1. That the Committee on Rate Fundamentals and its work be continued; and

2. That the Committee be authorized to cooperate, in any way which may seem advisable and prove acceptable, with the Council on Public Utility Law of the American Bar Association and with any other public organizations working in this field of law.

REPRESENTATION OF AMERICAN ENGINEERING STANDARDS COMMITTEE

A. H. Hall, New York, N. Y.

During the past year the work of the American Engineering Standards Committee has grown with such rapidity, as a result of the large demands made upon it by various industrial organizations and governmental agencies, that it has become necessary to provide for increased staff and facilities.

One hundred and forty-one projects are now being handled under the auspices of the A E S C in the following fields: civil engineering and building trade, 26; mechanical, 25; electrical 16; automotive (aircraft and automobile), 4; transport, 12; ships and their machinery, 1; ferrous metals, 15; non-ferrous metals, 12; chemical, including chemical engineering, 12; textiles, 2; mining, 5; general, 11. Over two hundred trade and technical organizations are cooperating in this work through more than one thousand accredited representatives.

Recently the following member-bodies have been added to the committee: National Association of Manufacturers of the United States of America, and the Telephone Group, consisting of the Bell Telephone System and the U. S. Independent Telephone Association. There are now 24 member-bodies, including 7 departments of the federal government, 9 national engineering societies and 19 national industrial associations, comprising in all 35 separate national organizations.

The following are a few of the outstanding developments which have taken place during the past year:

Federal Specifications Board. The Federal Specifications Board submits specifications to the A E S C, before definite adoption by the board, for the criticism of the industries concerned in the particular specifications. This tends to unify government and commercial specifications into national specifications recognized and applied by government and industry alike. Up to the present time the Federal Specifications Board has submitted sixty specifications to the A E S C for criticism. The list covers those which seem to be of special interest to the Association:

- Asphalt for Mineral Surface Roofing
- Asphalt Primer for Coating Concrete
- Asphalt Saturated Rag Felt (Roofing)
- Asphalt for Waterproofing
- Chrome Ore (Ground for Refractories)
- Coal Tar Pitch for Roofing
- Coal Tar Saturated Rag Felt for Roofing and Waterproofing
- Coal Tar Pitch for Waterproofing
- Creosote Oil
- Foundry Pig Iron
- Gray Iron Castings
- Hair Felt Insulation
- Hose for Various Purposes (13 Specifications)
- Malleable Iron Castings

Manila Rope
Oil Suction and Discharge Hose
Packing and Gaskets
Surfacing Materials for Bituminous Built-up Roofing
Welding Wire (Iron and Steel)
Wood Screws

This work of cooperation with the Federal Specifications Board is being carried on under the general direction of a small special committee of the American Engineering Standards Committee, of which your representative is chairman. Dr. D. R. Harper, 3d, has been appointed by the chairman of the board as liaison representative succeeding Dr. A. S. McAllister, who formerly acted in this capacity. Dr. Harper is also serving as special liaison officer of the Bureau of Standards for cooperative work with the A E S C and, to facilitate his work, makes his headquarters in the offices of the committee.

Department of Commerce. During the past year, the committee has developed its cooperative relations with the Department of Commerce through the Department's Division of Simplified Practice. The most important activity in this connection was the canvass which the A E S C undertook at the request of the Secretary of Commerce. Questionnaires were sent out to a number of the organizations cooperating as member-bodies or in other ways with the A E S C, requesting suggestions as to possible subjects for simplification or standardization. More than 1,000 subjects were suggested. The American Gas Association cooperated in this research and submitted a number of suggested projects for simplification and standardization which have been submitted to Secretary Hoover.

On June 11, 1923, Secretary Hoover of the Department of Commerce called a conference of representatives of a number of organizations interested in standardization and laid before them a plan for the compilation of specifications applicable to the purchase of commodities. In connection with this plan, he has appointed an Advisory Committee, in which the A E S C is represented by its Chairman, Mr. A. W. Whitney, to advise him on means for carrying on this activity and for making it useful as possible to American industry. At the same time, Mr. Hoover recalled Dr. A. S. McAllister, who has been with the A E S C for the past two years as liaison officer of the Bureau of Standards and the Federal Specifications Board, for work in connection with this compilation or encyclopedia of specifications.

Preferred Numbers. Considerable study has been given to the general principles underlying standardization of sizes, particularly the system of "preferred numbers," based on a suitable series, such as is being adopted by the industries of France and Germany. This scheme, which is applicable to nearly all kinds of sizes and ratings and provides for a systematic series of sizes which step up on a rational basis from size to size, is regarded abroad as of fundamental importance and has, in fact, been characterized as the most important single contribution to the technique of standardization. If it proves applicable to the problems of American industry, it may lead to great economies in material, labor, and in the work of design. The A E S C is now organizing a special committee, headed by Mr. C. E. Skinner, Assistant Director of Engineering, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., to attempt to work out such a system of preferred numbers for this country.

Conference of Secretaries. The Second Unofficial Conference of Secretaries of the National Standardizing Bodies was held in Switzerland in July and was attended by the Committee's Secretary, Dr. P. G. Agnew. There are now sixteen active standardizing bodies, located in Australia, Austria, Belgium, Canada, Czechoslovakia, France, Germany, Great Britain, Holland, Hungary, Italy, Japan, Norway, Sweden, Switzerland and the United States. All of these bodies, with the exception of the Hungarian and Japanese, were represented at the conference.

Sustaining-Membership. At present, the annual expenditure of the A E S C amounts to about $35,000, of which $20,000 is covered by dues of member bodies. The deficit has, in the past, been made up by contributions from companies closely interested in the work. To provide for the increased volume of undertakings with which the A E S C is concerned, a permanent plan of financing through sustaining-memberships of individual industrial concerns has been developed. Sustaining-membership dues are on the basis of approximately one cent per thousand dollars of gross receipts (total annual business). A bulletin service, consisting of information on significant current developments in standardization work, both in this country and abroad, will be furnished from time to time to sustaining-members. An engineer-translator will later be added to the staff to facilitate the provision of such a service. It is hoped to increase the annual income in this manner by about $50,000.

Appended are lists of the A E S C member-bodies, officers and committees and standards officially approved by the Committee prior to August 1, 1923.

AMERICAN ENGINEERING STANDARDS

Officially Approved By The American Engineering Standards Committee To August 1, 1923

A—CIVIL ENGINEERING AND BUILDING TRADES

A 1-1922 Portland Cement, Specifications and Tests for—American Standard
American Society for Testing Materials C 9-21

A 2-1919 Fire Tests of Materials and Construction, Specifications for—Tentative American Standard
American Society for Testing Materials C 19-18

A 5-1921 Toughness of Rock, Test for—Tentative American Standard
American Society for Testing Materials D 3-18

A 6-1922 Drain Tile, Specifications for—Tentative American Standard
American Society for Testing Materials C 4-21

A 7-1921 Bituminous Materials Suitable for Road Treatment, Method of Distillation of—Tentative American Standard
American Society for Testing Materials D 20-18

A 8-1922 Bituminous Materials, Method of Test for Penetration of—Tentative American Standard
American Society for Testing Materials D 5-21

A11-1921 Lighting Factories, Mills and Other Work Places, Code of—American Standard
Sponsor—Illuminating Engineering Society

A14-1923 Ladders, Safety Code for—Tentative American Standard
Sponsor—American Society of Safety Engineers

A18-1923 Concrete, Method of Test for Unit Weight of Aggregate—Tentative American Standard
American Society for Testing Materials C 29-21

A19-1923 Concrete, Method of Test for Voids in Fine Aggregate—Tentative American Standard
American Society for Testing Materials C 30-22

A20-1923 Concrete, Method of Test for Organic Impurities in Sands—Tentative American Standard
American Society for Testing Materials C 40-22

B—MECHANICAL

B 2-1919 Pipe Thread—American Standard
Sponsors—American Gas Association
The American Society of Mechanical Engineers

B 7-1922 Abrasive Wheels, Safety Code for the Use, Care and Protection of—Tentative American Standard
Sponsors—International Association of Industrial Accident Boards and Commissions
Grinding Wheel Manufacturers Association of the U. S. and Canada

B 8-1922 Foundries, Safety Code for the Protection of Industrial Workers in—Tentative American Standard
Sponsors—American Foundrymen's Association
National Founders Association

B11-1922 Power Presses and Foot and Hand Presses, Safety Code for—Tentative American Standard
Sponsor—National Safety Council

B15-1923 Power Transmission Apparatus, Mechanical, Safety Code for—Tentative American Standard
Sponsors—American Society of Mechanical Engineers
International Association of Industrial Accident Boards and Commissions
National Bureau of Casualty and Surety Underwriters

C—ELECTRICAL

C 1-1921 Electric Wiring and Apparatus in Relation to Fire Hazard, Regulations for ("National Electrical Code")—American Standard
Sponsor—National Fire Protection Association

C 2-1922 Electrical Safety Code ("National Electrical Safety Code")—American Standard
Bureau of Standards, Handbook No. 3

C12-1922 Meters, Electricity, Rules for ("Code for Electricity, Meters")—American Standard
Association of Edison Illuminating Companies
National Electric Light Association

C15-1923 Trolley Construction, 600 Volt Direct Current Overhead, Recommended Specification for—Tentative American Standard
American Electric Railway Association, Ds 2c

D—AUTOMOTIVE

D 2-1922 Automobile Headlighting Specifications—Laboratory Test for Approval of Electric Headlighting Devices for Motor Vehicles—Tentative American Standard
Illuminating Engineering Society

E—TRANSPORT

E 2-1923 Rails, Joint Plates for Seven-Inch Girder Grooved and Girder Guard, Recommended Design for—American Standard
American Electric Railway Association Wm 4b

E 3-1923 Rails, Joint Plates for Nine-Inch Girder Grooved and Girder Guard, Recommended Design for—American Standard
American Electric Railway Association Wm 5a

E 4-1923 Rail, Seven-Inch Girder Grooved, Design for—American Standard
American Electric Railway Association Wr 4c

E 5-1923 Rail, Nine-Inch Girder Grooved, Design for—American Standard
American Electric Railway Association Wr 3c

E 6-1923 Rail, Seven-Inch Girder Guard, Design for—American Standard
American Electric Railway Association Wr 6a

E 7-1923 Rail, Nine-Inch Girder Guard, Design for—American Standard
American Electric Railway Association Wr 5a

G—FERROUS METALS

G 6-1921 Screw Stock Cold-Drawn Bessemer Steel Automatic, Specifications for—Tentative American Standard
American Society for Testing Materials A 32-14

G 7-1921 Screw Stock Cold-Drawn Open-Hearth Steel Automatic, Specifications for—Tentative American Standard
American Society for Testing Materials A 54-15

G12-1923 Bars, Refined Wrought-Iron, Specifications for—Tentative American Standard
American Society for Testing Materials A 41-18

G13-1923 Plates, Wrought-Iron, Specifications for—Tentative American Standard
American Society for Testing Materials A 42-18

G14-1923 Bars, Staybolt, Engine Bolt and Extra Refined Wrought-Iron, Specifications for—Tentative American Standard
American Society for Testing Materials A 84-21

H—NON-FERROUS METALS

H 2-1921 Electrolytic Copper Wire Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars, Specifications for—Tentative American Standard
American Society for Testing Materials B 5-13

H 3-1921 Lake Copper Wire Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars, Specifications for—Tentative American Standard
American Society for Testing Materials B 4-13

H 4-1921 Copper Wire, Soft or Annealed, Specifications for—Tentative American Standard
American Society for Testing Materials B 3-15

K—CHEMICAL, INCLUDING CHEMICAL ENGINEERING

K 3-1921 Manganese Bronze, Methods of Chemical Analysis of—Tentative American Standard
American Society for Testing Materials B 27-19

K 4-1921 Gun Metal, Methods of Chemical Analysis of—Tentative American Standard
American Society for Testing Materials B 28-19

K 5-1922 Alloys of Lead, Tin, Antimony and Copper, Chemical Analysis of—Tentative American Standard
American Society for Testing Materials B 18-21

K 6-1922 Coke, Methods of Laboratory Sampling and Analysis of—Tentative American Standard
American Society for Testing Materials D 37-21

K 8-1923 Liquids, Volatile, Flammable, Method of Test for Flash Point of—Tentative American Standard
American Society for Testing Materials D 56-21

K 9-1923 Pigments, White, Methods of Routine Analysis of—Tentative American Standard
American Society for Testing Materials, D 34-17

K10-1923 Pigments, Yellow, Orange, Red and Brown, Containing Iron and Manganese, Methods of Routine Analysis of—Tentative American Standard
American Society for Testing Materials D 50-18

K11-1923 Lead, Dry Red, Methods of Routine Analysis of—Tentative American Standard
American Society for Testing Materials D 49-18

K12-1921 Copper, Methods for Battery Assay of—Tentative American Standard
American Society for Testing Materials B 34-20

M—MINING

M 4-1922 Explosives, Permissible, Specifications for the Testing and Use of—American Standard
U. S. Bureau of Mines

X—MISCELLANEOUS

X 1-1921 Coal, Method for Sampling of—Tentative American Standard
American Society for Testing Materials D 21-16

X 2-1922 Heads and Eyes of Industrial Workers, Safety Code for the Protection of the—American Standard
Sponsor—Bureau of Standards

X 7-1922 Illuminating Engineering Nomenclature and Photometric Standards—American Standard
Illuminating Engineering Society

OFFICERS AND COMMITTEES FOR 1923

Albert W. Whitney
Chairman

P. G. Agnew
Secretary

John A. Capp
Vice-Chairman

F. J. Schlink
Asst. Secretary

PAST CHAIRMEN

Comfort A. Adams, 1918, 1919
A. A. Stevenson, 1920, 1921

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Comfort A. Adams
Geo. K. Burgess
Coker F. Clarkson
Francis J. Cleary
W. A. E. Doying
E. A. Frink
R. G. Guyer
Carl M. Hansen
O. P. Hood
Sullivan W. Jones
Thos. H. MacDonald
A. H. Moore
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Dana Pierce
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U. S. BUREAU OF STANDARDS AND FEDERAL SPECIFICATIONS BOARD

D. R. Harper 3d, Liaison Officer

CORRELATING COMMITTEES

General Correlating Committee for Mining Standardization
E. A. Holbrook, Chairman
Warren R. Roberts, Vice-Chairman

SAFETY CODE CORRELATING COMMITTEE

Sidney J. Williams, Chairman
L. W. Chaney, First Vice-Chairman
M. G. Lloyd, Second Vice-Chairman

MEMBER-BODIES AND REPRESENTATIVES

American Electric Railway Association	Martin Schreiber 1924
American Institute of Architects	Sullivan W. Jones 1923
American Institute of Electrical Engineers	Henry M. Hobart .... 1923 Harold Pender .... 1924 C. E. Skinner .... 1925 Alternate: L. T. Robinson
American Institute of Mining and Metallurgical Engineers	Graham Bright .... 1923 George C. Stone .... 1924 Geo. E. Thackray 1925
American Railway Association, Engineering Division	E. A. Frink .... 1924 Alternate: J. R. W. Ambrose
American Society of Civil Engineers	J. J. Yates .... 1923 H. H. Quimby .... 1924 Chas. A. Mead .... 1925 Alternate: Harry N. Latey
American Society of Mechanical Engineers	Stanley G. Flagg, Jr. .... 1923 Eugene C. Peck .... 1924 Fred. E. Rogers .... 1925 Alternates: Cloyd M. Chapman and Wm. P. Eales
American Society for Testing Materials	C. D. Young .... 1923 John A. Capp .... 1924 A. A. Stevenson .... 1925 Alternate: C. L. Warwick
Association of American Steel Manufacturers	C. F. W. Rys .... 1924 Alternate: J. O. Leech
Electrical Manufacturers' Council Associated Manufacturers of Electrical Supplies Electrical Manufacturers' Club Electric Power Club	LeRoy Clark .... 1923 R. W. E. Moore .... 1924 A. H. Moore .... 1925 Alternates: A. L. Doremus and C. A. Bates
Electric Light and Power Group Association of Edison Illuminating Companies National Electric Light Association	N. A. Carle .... 1923 I. E. Moultrop .... 1924 S. G. Rhodes .... 1925 Alternate: Alexander Maxwell
Fire Protection Group Associated Factory Mutual Fire Insurance Companies National Board of Fire Underwriters National Fire Protection Association Underwriters' Laboratories	Ira H. Woolson .... 1923 Dana Pierce .... 1924 Edward A. Barrier 1925
Gas Group American Gas Association Compressed Gas Manufacturers' Association International Acetylene Association	A. Cressy Morrison ..... 1923 H. S. Smith .... 1924 A. H. Hall .... 1925 Alternate: Wm. J. Serrill
National Association of Manufacturers of the United States of America	Carl M. Hansen 1925
Panama Canal	W. A. E. Doying .... 1925 Alternate: P. H. Greenwood
Safety Group: National Bureau of Casualty & Surety Underwriters National Safety Council	David Van Schaack .... 1923 Albert W. Whitney ..... 1924 Sidney J. Williams ..... 1925 Alternates: C. B. Auel and L. L. Hall
Society of Automotive Engineers	Chas. M. Manly .... 1923 Coker F. Clarkson ...... 1924 B. B. Bachman 1925

Telephone Group:	
Bell Telephone System	F. L. Rhodes .... K. L. Wilkinson ....
U. S. Independent Telephone Association	
U. S. Department of Agriculture	Thos. H. MacDonald .... 1923 D. J. Price .... 1924 Earle H. Clapp .... 1925 Alternates: H. S. Betts, A. T. Goldbeck & H. E. Roethe
U. S. Department of Commerce	F. C. Brown .... 1923 L. J. Briggs .... 1924 C. K. Burgess .... 1925 Alternates: E. C. Crittenden and N. F. Harriman
U. S. Department of the Interior	O. P. Hood .... 1923 E. A. Holbrook .... 1924 P. S. Smith 1925
U. S. Department of Labor	Ethelbert Stewart ...... 1925 Alternate: Lucian W. Chaney
U. S. Navy Department	Francis J. Cleary .... 1923 Henry Williams .... 1924 Harvey Delano 1925
U. S. War Department	Dana T. Merrill .... 1923 R. G. Guyer .... 1924 Alternates: John B. Rose, C. McK. Saltzman and J. Moultrie Ward

NATIONAL FIRE PROTECTION ASSOCIATION

R. S. Doull, *Chairman,* New York, N. Y.

The Committee is in close touch with the work of the N. F. P. A. and through its representation upon committees it is afforded every opportunity to participate in the preparation of codes which have for their object the prevention of the fire waste of our country, as well as in the general work of the association.

Through our active work upon committees in recent years, we have been successful in preventing the adoption of any code containing illy advised provisions or requirements which would be burdensome or harmful to our industry.

It is a pleasure to record that the National Board of Fire Underwriters as well as the N. F. P. A., realizing that the American Gas Association is cooperating with them in safeguarding property against fire, gives due weight to any suggestion for amendment we may present before promulgating a code, as well as submitting to us for an opinion all questions in any way relating to our industry which may come before them during the year.

The chairman of the committee attended the annual convention of the N. F. P. A. held in Chicago on May 8, 9 and 10 of this year, and succeeded in having an objectionable measure, which a committee contemplated presenting for adoption, referred back to the committee in order that the American Gas Association could have sufficient time to consider its provisions and to prepare and present such amendments as they deem necessary.

REPRESENTATION ON UNITED STATES NATIONAL COMMITTEE OF THE INTERNATIONAL COMMISSION ON ILLUMINATION

H. Lyon, Gloucester, N. J.
E. H. Earnshaw, Newark, N. J.
G. G. Ramsdell, New York, N. Y.

The U. S. National Committee of the International Commission on Illumination held a meeting in Room 901, Engineering Societies Building, June 7, 1923, at 2 p. m. to receive and act upon report of Dr. E. P. Hyde, on the question of the advisability of attempting to hold a meeting of the Commission in this country in 1924, with the following members present:

Messrs. C. H. Sharp, President; Howard Lyon, Secretary; E. P. Hyde, L. B. Marks, E. H. Earnshaw, Geo. G. Ramsdell.

In accordance with a resolution of the National Committee duly carried at the meeting of January 23, 1923, in effect that Dr. E. P. Hyde be requested in behalf of the U. S. National Committee to sound out the views of foreign membership as to the desired time and place of the next plenary meeting and particularly foreign views as related to the practicability of holding the meeting in the United States, Dr. Hyde reported as follows:

It was hoped that the foreign situation might in course of time assume a more favorable attitude, but as time went on and there seemed to be no immediate prospect of improvement, letters were addressed to representative members of foreign committees in France, Switzerland, Italy and England with the view to obtaining individual opinion.

Replies to these letters indicated a sentiment which was practically unanimous in general conclusions, namely, that there was scant prospect of attendance of any considerable number of foreign members for an American meeting in 1924. Opinions were practically in agreement with those obtained by the interviews of Dr. C. H. Sharp with foreign members and reported by Dr. Sharp at the last meeting.

Difficulties in the way of attendance centered about the problem of exchange.

Briefly, it seemed wiser to hold the meeting as planned in 1924 but somewhere in Europe. In general it seemed undesirable to postpone a meeting, say for a year.

Members abroad expressed a strong desire to attend an American meeting and so witness various features of accomplishment in theory and developed practice in relation to problems of illumination, but the journey at this time seemed impracticable.

After full discussion the following resolution was adopted:

Whereas, the U. S. National Committee of the International Commission on Illumination, after due investigation, has come regretfully to the conclusion that conditions are such as to make it doubtful whether the best interests of the I. C. I. would be served by carrying out the plan formulated at the plenary meeting in Paris in 1921 of holding the next plenary meeting of the Commission in the United States in 1924: be it therefore

Resolved: that although the U. S. National Committee would welcome an opportunity of arranging for a meeting in this country in 1924, yet it is willing in the best interests of the Commission, to waive whatever rights it may have in this regard, and to submit the question of the place and time of the next plenary meeting to the Executive Committee of the Commission.

Furthermore: be it resolved that the U. S. National Committee hopes and trusts that in case the 1924 plenary meeting is not held in the United States the next following plenary meeing may be scheduled for this country.

COOPERATION WITH EDUCATIONAL INSTITUTIONS

C. N. Chubb, *Chairman,* Davenport, Iowa.

The work of this committee consisted in the formulation of a plan whereby state committees would be formed, chairmen of which would be members of a national committee. The duties of the state committee would be: first, to create friendly feelings and relationship between the American Gas Association company members and the educational institutions throughout the country, and, second, to promote the cooperation of gas companies with educational institutions graduating men available for the gas business by providing studies with experimental work in connection with thesis work or for special research and be ready to cooperate with students in performing such work. Gas companies should employ undergraduates during vacation period and take on as many graduates as possible each year, thereby encouraging educational institutions to have subjects of special interest to the gas industry in their curriculum and advising students that there are good openings in the gas field.

CUSTOMER OWNERSHIP

Charles A. Munroe, Chairman, Chicago, Ill.

Your Committee on Customer Ownership was gratified and surprised to learn of the great interest shown in this subject by the member companies. Up to the time of preparing this report, 187 replies to questionnaires had been received. These replies have been summarized and attached to this report.

During the period covered by the questionnaire, which was the year 1922, and the first eight months of 1923, there were sold by gas companies 550,708 shares of stock to 107,094 purchasers. There were sold by combination gas and electric companies in the same period 700,932 shares of stock to 120,076 purchasers, or a grand total of 1,251,640 shares of stock sold to 227,170 purchasers. The average number of shares of stock purchased by one person was 5.50 shares. The aggregate amount of money received from these sales was $106,836,000.

This vast sum of money was obtained at a cost so low as to be heretofore unknown. The financial structure of the companies has been improved by strengthening the position of the senior securities, and in addition what it means to this industry in the way of better public relations to have upwards of 225,000 investors interested in the business cannot even be calculated.

The most satisfactory way to acquaint our customers with the problems of our business is to have the customer an owner in the business. Many of the difficulties of the past will be avoided through a better understanding of our business, brought about through customer ownership, and a sure antidote to municipal ownership is ownership by the public of our securities.

To the companies who have not yet undertaken the sale of securities to their customers, the committee submits as a suggestion the plan of one of the large companies which is working successfully:

1. The sale of stock is for cash or on time. If on time $10.00 per share is obtained at the time the customer signs the contract and $10.00 per share per month until the final payment is made.

2. Interest at 6% per annum is allowed on all payments made where the stock is sold on the deferred payment plan.

3. Commissions:

Cash Sales

1 share	$2.50
2 shares	4.50
3 shares	6.00
4 shares	7.00
5 shares	8.00
Excess shares up to 50 shares per share	1.00
Excess beyond 50 shares, per share	.25

Deferred Payment Sales

1 share	$2.25
2 shares	4.00
3 shares	5.25

4 shares	$6.00
5 shares	6.75
Excess shares up to 50 shares, per share	.75
Excess beyond 50 shares, per share	.25

4. Balance paid within 30 days on any one sale constitutes a cash sale.

5. Where stock is sold on the deferred payment plan and the purchaser is in default before three payments have been made, the commission is charged back to the salesman.

6. No promise is made by the company that it will give back to the purchaser the price paid for the securities. The cost of money determines the price of all securities including the obligations of the United States Government, and it would be unnatural for the securities of a public utility to not fluctuate with the rest of the market, in accordance with the cost of money.

7. No promise is made by the corporation to buy back the security. (Provision may be made to either oversell the issue, or continue from time to time the sale, in order to provide a ready market for the securities.)

8. Payments on defaulted contracts are returned after an effort has been made to get the purchaser to continue to finish his payments.

SUMMARY

Answers to Questionnaires Regarding Customer Ownership Campaign

Period of Campaign—January 1, 1922, to about September 1, 1923.
Number of Replies Received up to October 12, 1923—187

Of the replies received, the answers are as follows:

Stock sold by:				
Gas Companies	20		11%	
Gas and Electric Companies	39		21%	
Total		59		32%
Bonds Sold	4		2%	
Sales Campaign planned for future	15		8%	
No sales made or planned	109		58%	
Total replies		187		100%

Of the Gas Companies Selling Stock

2 sold	5,076	shares of Prior Lien	to 373	purchasers
14 sold	513,297	shares of Preferred	to 104,612	purchasers
4 sold	32,335	shares of Common	to 2,109	purchasers
Total	550,708		107,094	

Of the Gas and Electric Companies Selling Stock

2 sold	11,793	shares of Prior Lien	to 1,474	purchasers
40 sold	581,221	shares of Preferred	to 98,560	purchasers
9 sold	107,918	shares of Common	to 20,042	purchasers
Total	700,932		120,076	

Some of these companies sold all three or two of the three kinds of stock.

Combined Sales of the Gas and of the Gas and Electric Companies.

4 sold	16,869 shares of Prior Lien	to	1,847	purchasers
54 sold	1,094,518 shares of Preferred	to	203,172	purchasers
13 sold	140,253 shares of Common	to	22,151	purchasers
Total	1,251,640		227,170	

The greatest number of shares sold by one company (The Consolidated Gas Company of New York) was 300,000

The smallest number of shares sold by one company was 36

The greatest number of purchasers from one company was 57,283

The smallest number of purchasers from one company was 8

The average purchase of stock by one person was ....5.5 shares

Par Value	Prior Lien	Preferred	Common
High	$100	$100	$100
Low	$ 25	$ 50	$ 10

The par value of the great majority of stock sold was $100 per share.
Two companies sold common stock of no par value.

Selling Price	Prior Lien	Preferred	Common
High	$105	$105	$135
Low	$ 25	$ 50	$ 10

17 companies sold below par
16 companies sold above par
26 companies sold at par

Commissions paid range from $.50 to $15.00 per share, but the greater number of companies paid $2.00 per share. Nine companies paid no commission.

The average commission on all stock sold is approximately $2.50 per $100 share.

The cost per share of selling the stock varies from $.50 to $15.00. The $15.00 was the cost to one company of selling Prior Lien Stock. To the greater number of companies the cost of selling was approximately $5.00 per $100 share.

The Total Amount of Money Raised $106,836,000
The Total Value of Securities $108,077,000

Methods used by various Companies in selling:

1. Employees 29
2. Newspaper advertisements 19
3. Circulars 10
4. Regular full-time salesmen 13
5. Prizes 2
6. Establishment of investment accounts 3
7. Local banks 1
8. "Teams" 1
9. "Stuffers" 2
10. House to house canvass 1
11. Sales forces organized 2
12. Assistant treasurer 1
13. A letter to each customer, each employee 1
14. Booklets 1
15. Sales department under man from Securities Department 1
16. Bill-board advertisements 1
17. Brokers 4

(Motion made, seconded, and carried that the report of the Committee on Customer Ownership be accepted and printed in the Proceedings.)

REPORT OF REPRESENTATION OF A. G. A. MEMBERSHIP IN THE CHAMBER OF COMMERCE OF THE UNITED STATES OF AMERICA

D. D. Barnum, *National Councillor,* Boston, Mass.

During the year your Delegates to the Chamber of Commerce of the United States have cast their votes on two referendums submitted by that body.

The first, Referendum No. 40, was on the report of the Committee on Education. The final returns from the entire country show a large majority registered their votes in opposition to: (1) the creation of a Federal Department of Education with a secretary in the President's cabinet, (2) enlarging the present Federal Bureau of Education, (3) principle of federal aid to education in the states on a basis of states appropriating sums equal to those given by the federal government.

The results of the second, Referendum No. 41, on the Report of the Committee on Trade Associations, show the great majority agreed as to the necessity of trade associations and their general activities.

Mr. George B. Cortelyou, in my absence due to illness, acted as our National Councillor at the eleventh annual meeting of the Chamber held in New York, May 8 to 10, 1923. Mr. Cortelyou was fortunate in having the earnest assistance of the following delegates and alternates: Messrs. W. E. McKay, W. F. Douthirt, E. H. Rosenquest, A. E. Forstall, W. R. Addicks, P. S. Young and A. W. Flor.

In the face of very strong opposition, our delegation, with the help of the very thorough pre-meeting action of our headquarters staff, secured the election of Mr. Philip H. Gadsden as a director in the Chamber. Our Association will thus have a direct representation on the Board of Directors of that very important organization.

Your delegation also secured at the annual meeting of the Chamber of Commerce the passage of a very fine resolution endorsing state public utilities regulation and also a resolution on tax-exempt securities.

I believe our Association has been effectively represented through the year in the Chamber. All literature is carefully scrutinized by our headquarters staff and we are fully informed on all matters of interest. I feel however, that Mr. Cortelyou and his co-workers, representing our Association at the annual meeting of the Chamber, are to be especially commended for the very fine results they were instrumental in obtaining.

(Motion made, seconded, and carried that the report of the National Councillor be accepted and printed in the Proceedings.)

The president then invited Mr. E. J. Stephany, chairman of the Industrial Gas Section, to occupy the chair during the presentation of an address on behalf of that section by Mr. Charles A. Munroe, on the subject of:

INDUSTRIAL GAS—ITS PLACE IN THE INDUSTRY

Charles A. Munroe, Vice-President, Peoples Gas Light & Coke Co., Chicago, Ill.

I feel singularly honored that I should be selected to be the representative of the Industrial Gas Section to make its maiden address to this Association. At the time of the founding of the American Gas Association, I was selected as chairman of the Commercial Section, and I shall never forget my chagrin when a tentative program of the Commercial Section for the annual convention was handed to me, to observe the place which industrial gas had on that program. It was relegated to the last afternoon of the last day of the convention.

It is a source of great gratification and pride that the industrial work has become so generally recognized as of value to the industry.

I personally believe that if every section of this convention, and I will bar none, should close their doors, and the entire time and attention of the convention were centered upon the problems relating to the application of gas for industrial purposes, that the greatest good would thereby arise.

It is important to cheapen the cost of production; it is important to have instruments of precision; it is important to handle our accounts in the cheapest and most accurate manner possible; but the most important thing of all is to be able to market the product which we produce, at a profit. If we cannot do this, all of the other operations come to naught.

The gas industry has experienced one complete change in the character of its business, and, as a result of such a change, has emerged from the transition stronger than ever. It is now destined for a more radical change, viz: from serving the home to serving the factory. There is not a man in this room who will not admit the first transition, viz. from the lighting of the home to the cooking in the home; and to make clear the necessity for the second transition in the business, I have prepared data and charts which will prove beyond controversy the desirability, in fact, the necessity of such a course. (See page 268.)

Approximately 98% of all of the customers of gas plants are served through 3, 5, and 10 light meters. Although it has been often referred to, it should be referred to again and again, until everyone in this industry understands it, and that is the unprofitable character of the business served through the great majority of 3, 5, and 10 light meters. This result is due for the most part to the unjust and unscientific and unfair system of rates which has grown up in this industry over a long period of years,

Consumption and Income
from
Customers Supplied Through 3, 5, and 10 Light Meters
Mostly Domestic

Year	Consumption per Customer	Income per Customer	Average Rate per MCF
1913	2,551	$2.04	$ .800
1918	2,582	2.03	.784
1919	2,570	2.29	.892
1920	2,719	2.84	1.043
1921	2,501	3.02	1.208
1922	2,500	2.73	1.093
1923	2,553	2.74	1.073

Present Cost to Serve a Customer with 100 Feet of Demand

Customer Charge	$ .36
Demand Charge	1.50
Output Charge	.53 per MCF

Cost to serve Customer using 2,553 Cubic Feet per month is $3.21, or $1.26 per M Cubic Feet based on data for 8 months.

PROFITABLE AND UNPROFITABLE CUSTOMERS

	Percentage of Total Number of Customers	Percentage of Total Annual Consumption
Customers Using 3,900 cubic feet or less per month	84%	47%
Customers Using over 3,900 cubic feet per month	16%	53%
Total	100%	100%

and which it will take another long period of years to correct.

An analysis of the figures will show that the customer's charge amounts to 36c a month; the demand charge for a 5 light meter, $1.50 a month; and the output charge 53c per 1,000 cubic feet. The average consumption through a 3, 5, and 10 light meter for the eight months of 1923 in Chicago was 2,553 cubic feet. It costs to serve a customer using 2,553 cubic feet of gas the sum of $3.21, and under the rates which prevail in The Peoples Gas Light & Coke Company territory, the average customer pays us $2.74. Therefore the average of the 3, 5, and 10 light meters, comprising more than 98% of all of the customers of The Peoples Gas Light & Coke Company, represents a loss of 47c per month.

It is important to bear in mind that although there is a loss in serving the average 3, 5, and 10 light consumer, yet 20% of such consumers are very profitable because they use far in excess of the average consumption per month, and even the balance of this class which show a loss, when there is allocated to that class the fair share of all the cost, yet, because the investment is made and many of the overheads of the company would go on just the same, even if such consumers should cease using gas, the company is better off having these customers use gas than if they should stop using gas entirely.

The above figures do show that you cannot take new business of the 3, 5, and 10 light meter class, without taking a definite monthly loss on 80% of all such customers.

In connection with the foregoing table, I want to direct your attention to that part of the table which shows the average number of cubic feet used by the 3, 5, and 10 light meters in the year 1913, and in the years 1919 to 1923. It is impossible to give you a statement of the average number of cubic feet for the years between 1913 and 1919 because our records were not kept in such a way that the consumption on these meters could be segregated.

The significant fact about this table is, that, notwithstanding all of our efforts in our commercial department to push water heaters, ranges and laundry equipment, and thereby increase the sales in the homes, and notwithstanding the vast volume of gas merchandise appliances which have been sold in the past ten years, the value of these appliances sold in the 12 months ending August 31, 1923, being estimated at $45,000,000, yet the average consumption through the 3, 5, and 10 light meters is no more today than it was ten years ago. In other words, the industry is simply holding its own.

Our industry in this regard is somewhat in the same predicament as the colored man who started out to drive to Jacksonville. He was told that it was twelve miles, and he started out about sunrise, and drove until 10:00 in the morning. He met a stranger on the road and he asked him how far it was to Jacksonville. The stranger stated that it was twelve miles. He drove on until well in the afternoon, when he met another traveler and he asked him how far it was to Jacksonville, and the gentleman replied: "Twelve miles." Along about sundown he came to a cross roads, where he met another man, and he said: "Stranger, can you tell me how far it is to Jacksonville?" The stranger replied: "Twelve miles." The colored fellow pulled up on the reins, and said, "Giddap mule! We are holding our own anyway."

This chart proves that notwithstanding all the efforts we have made to sell gas-fired laundry driers, gas-fired mangles, gas ranges, hot water heaters and the other appliances which we sell for the home, that we have just been holding our own.

This is one of the most disquieting facts in connection with our business. There is nothing to do except to strengthen our new business departments, and press on for still more appliance sales in the home, stimulate cooking in the home, and stop further loss in the volume of sales in the home. However, it is not enough in a great industry such as this, that we should hold our own; we must go forward, and the query is, where is the field for the profitable expansion of this industry? If 80% of the 3, 5, and 10 light meters do not give us sufficient revenue to pay their way, certainly expansion in this field should not be encouraged.

The table in relation to the 3, 5, and 10 light meters has been exhibited here not because it is new matter, because it is not, nor because I am a pessimist and an unbeliever in the gas industry—I am not; I believe it has a wonderful future.

Then why take up the time of this convention in presenting figures to show that 80% of our customers are carried at a loss? The table is shown and emphasized solely with the desire to make clear

to every man in this business that progress cannot be made through an accumulation of 3, 5, and 10 light meters, and that efforts to secure such business should be abandoned. Sufficient of that business will come without any effort on your part, and you will not be able to get away from furnishing such customers.

It may be that house heating with gas will be profitable. I sincerely hope that it will be. It is not clear that it is a field in which the gas companies can profitably enter. There are many distinguished men in this Association who feel it will present problems to the gas industry which it will not be able to profitably meet. There are others in this industry who are endeavoring to secure house heating business in order that precise data may be obtained which will prove whether this business is profitable or unprofitable.

If you cannot push for additional domestic consumers, if you cannot push for house heating business, where are you to turn to profitably develop this business?

We believe and know that the gas industry has found in the field of industrial gas an ever increasing and an ever profitable sphere of endeavor.

The inquiry naturally presents itself, what is the scope of the field for industrial gas? In order that we may more readily comprehend its importance, an effort has been made to compare it with the electrical industry.

In Chicago, the Commonwealth Edison Company sells 24% of its entire kilowatt-hour output for residence and commercial purposes, and 76% of its kilowatt-hour output is sold for power.

The gas company in the same city sells 76% of its gas output through 3, 5, and 10 light meters, and 24% of its gas for industrial purposes and large installations comparable with the power business of the electric company.

In other words, in that city, 76% of the business of the electric company is big business, and 24% is little business and in the gas company the exact reverse is true, 76% of the gas company's business is little business and 24% of the gas company's business is big business.

In order to get some idea of the relative importance of gas in the industrial plant, compared with the electric power in such a plant, we have taken at random, from the records of the gas company and of the Comonwealth Edison Company and the Public Service Company, nine customers who buy their electricity and who buy their gas for industrial uses, with the following results:

RELATIVE AMOUNTS PAID FOR ELECTRICITY AND GAS

Consumers in Chicago	*Annual Bill* *Electricity*	*Gas*	*Estimated Income if All Heat Processes were on Gas*
Crane Company 41st and Kedzie Avenue	$222,647	$ 38,942	$210,000
Chicago Tribune Company 150-80 E. Austin Avenue	36,041	18,051	18,051
Stewart Manufacturing Company 4530 Fullerton Avenue	26,546	77,927	77,927
Stewart-Warner Speedometer Company 1828 Diversey Parkway	53,760	82,327	82,327
Total	$338,994	$217,247	$388,305

Public Service Company of Northern Illinois			
Benjamin Electric Company	$ 21,866	$ 13,200	$ 42,000
Buda Company	55,933	35,624	70,000
Continental Can Company	21,328	12,633	12,633
Coonley Manufacturing Company	29,188	14,935	42,400
Hurley Machine Company	17,441	11,885	11,886
Total	$145,756	$ 88,277	$178,919
Grand Total	$484,750	$305,524	$567,224

The Stewart Mfg. Co. pays an annual electric bill of $26,546 and an annual gas bill of $77,927.

The Stewart-Warner Speedometer Mfg. Co. pays an annual electric bill of $53,760 and an annual gas bill of $82,327.

The Chicago Tribune Company pays an annual electric bill of $36,041 and an annual gas bill of $18,051.

The Hurley Mfg. Co. pays an annual electric bill of $17, 441 and an annual gas bill of $11,885.

The Continental Can Co. pays an annual electric bill of $21,328 and an annual gas bill of $12,633.

The Crane Company pays an annual electric bill of $222,647 and an annual gas bill of $38,942. Only part of the processes of this company to which gas can be applied are now being supplied with gas. This company's gas bill, when all of its processes are on gas, will go from $38,942 to $210,000.

The Benjamin Electric Mfg. Co. pays an annual electric bill of $21,866, and an annual gas bill of $13,200. This company's gas bill will be $42,000 instead of $13,200 annually when gas is applied to additional uses in the plant to which gas can be properly applied.

The Buda Company pays an annual electric bill of $55,933 and an annual gas bill of $35,624. When all of the processes of the Buda Company are on gas its gas bill will be $70,000 instead of $35,624 as at present.

The Coonley Mfg. Co. pays an annual electric bill of $29,188 and an annual gas bill of $14,935. When all of the processes of this company are on gas they will pay an annual gas bill of $42,400.

The sum total of these nine customers is as follows:

They pay at present an annual electric bill of $484,750 and an annual gas bill of $305,524. The annual gas bill of these customers when all of their processes are on gas will be $567,224, as against an annual electric bill paid by these same institutions of $484,750.

We believe that the industrial gas business offers to the gas industry a larger volume in dollars and cents than the volume in dollars and cents which the electric companies derive from the power business.

We believe that as the result of intensive effort in the industrial field over a period of years, that at least 76% of the annual sales of the gas company will be sold for industrial purposes, as against 24% which is the percentage of sales today.

Do not get the idea that industrial gas business is forced on the gas companies. It is obtained only by the most painstaking effort. But every job we get

makes it just that much easier to get the next one.

I take my hat off to the young industrial engineer who has the knowledge and imagination and the enthusiasm which enables him to go into a plant and secure business in the face of obstacles which are immediately placed in his path. In answer to an inquiry from the sales engineer, the superintendent of the plant replies somewhat as follows: "I can buy a gallon of oil for 5c and obtain 115,000 B.t.u. You ask me to buy 1,000 cubic feet of gas containing 575 B.t.u. per cubic foot, or 575,000 B.t.u. at 75c. With 5 gallons of oil at 5c per gallon or 25c, I can purchase the same number of B.t.u.'s for which you ask me to pay 75c. Your argument is an affront to my intelligence and I do not care to discuss the matter further with you."

I say I take my hat off to the young man who, in the face of such arguments, can start in to build, item by item, the shrinkage in the oil, the cost of handling and storing it, and the cost of atomizing it, until he brings up the cost from 5c to approximately 15c per gallon, thereby putting the oil on a comparative B.t.u. basis with the gas, and then can point out in addition all the collateral advantages in the use of gas.

Our greatest competitor for industrial gas business has been oil, but there is, lurking in the offing, another competitor of a more serious mien.

When you consider that the electrical companies are selling energy at 6.5c per kw.-hr. with a 10% discount on the low steps of the secondary rate, meaning a net rate of 5.85 per kw.-hr. and when you stop to consider that there are many industries that can utilize this energy without its being super-imposed upon their peak, you can see how close the theoretical cost of gas and electricity come, but the young men who have been able to meet the argument of the oil man, will be able to build up arguments which will successfully meet the electrical competition. They will add to the cost of the energy, the increased investment necessary to utilize the electricity; they will add the additional depreciation of the furnace; the cost of fuses and elements, and the same ingenuity which has enabled the industrial engineer to answer the oil man, will enable him to successfully answer the electric competition.

Is there any line of endeavor in the gas industry which appeals more to the imagination, which requires more ingenuity, which requires greater knowledge of so many different fields, than is required of the man who is engaged in the industrial work?

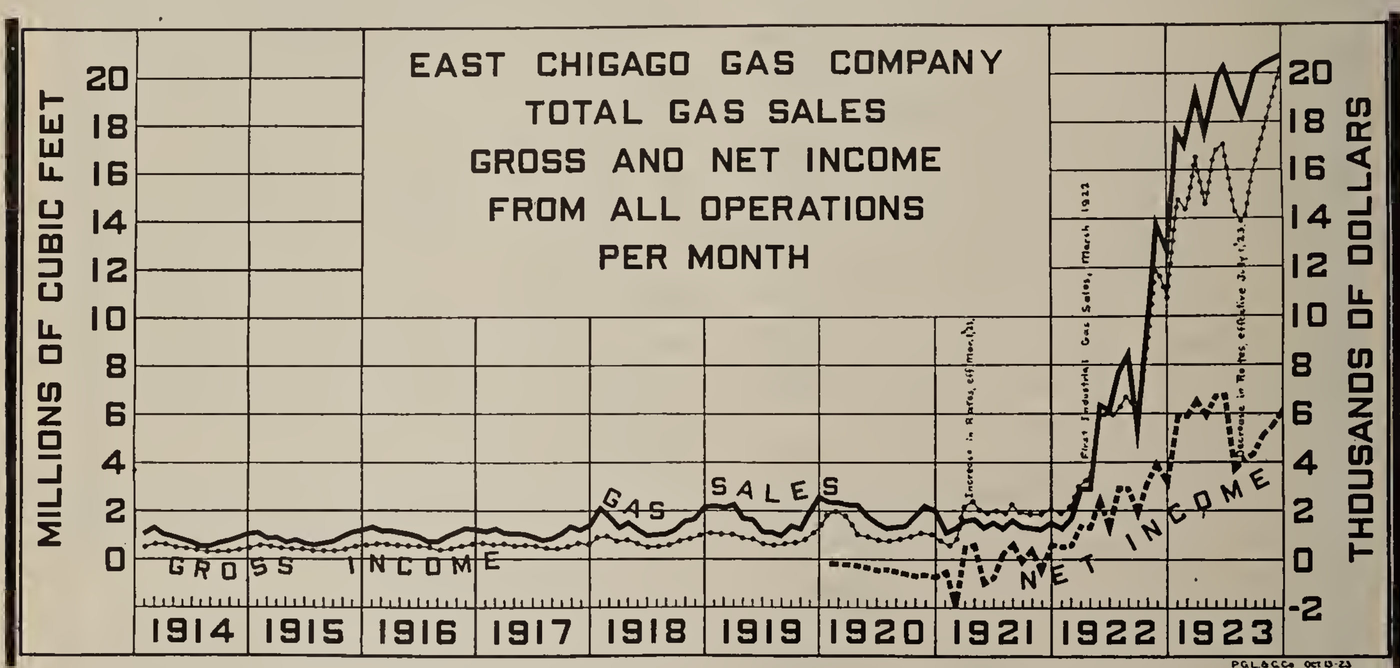
Several milestones in the gas business have been passed this year, which spell much for the industry.

Of first importance, is the creation of the Industrial Gas Section by the Executive Board of this Association. Attention is thereby focused on the problem of the industrial engineer and an importance to this branch of the business is given which it deserves.

Secondly, we have a magazine, entitled "Industrial Gas," devoted to the promulgation of the use of gas in industry. Its first issue was in July and it cannot help but play an important part in stimulating interest in the subject.

Thirdly, during the year forging furnaces have been increased in efficiency 30% with efficiencies as low as 3,000 cubic feet per ton of steel. The vitreous annealing furnace has been raised in efficiency 25%. Open type burners have been replaced with closed type burners,

such as the surface combustion tunnel type, and have reduced gas consumption 20%. There is one achievement which we must accomplish. It is difficult, and I must confess that I have not been able to work out a plan for its acomplishment, but we must work on it until it is an accomplished fact, and that is the encouragement of the designers and manufacturers of heavy duty appliances for the use of industrial gas.

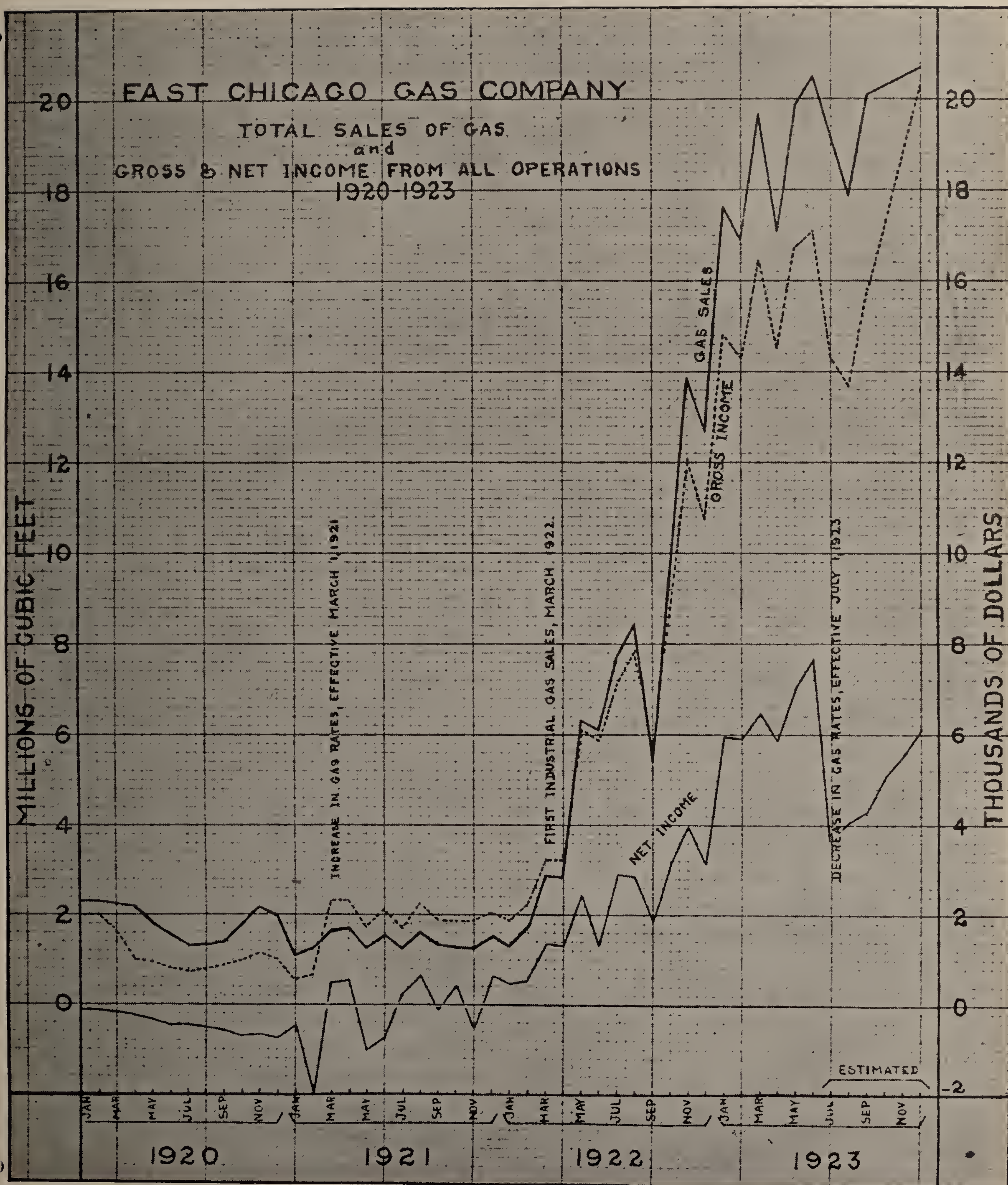


What a boon to the electrical industry has been the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Allis-Chalmers Company, and others of their class, is only appreciated by those who have been intimately associated with the development of that business. Where would the electrical industry be if each company had to develop its own translating devices?

We should encourage manufacturers of appliances to charge a round profit, and then some, for inventing apparatus. We must help them to make money so that they will be willing to give their time and energy and money towards the development of additional and more efficient apparatus. There is scarcely a company that is not spending more or less money in the design of apparatus. As an example, we wanted a brass melting furnace, and none could be found that would do the work, satisfactorily, and so we started in to develop our own. We spent a lot of time on it, and a lot of money and within the last few months one of the regularly established apparatus manufacturers has brought out a brass melting furnace far more efficient than the one which we had developed. How much better it would have been if we could have given the $5,000 we spent on this one piece of apparatus to the manufacturer. It would have helped him along and the whole industry.

Let us get behind the manufacturer and hold up his hands and help hold up his price so that he may have the disposition and resources to help us.

In order that you may see the profitable character of the industrial gas business, in the same light in which I see it, and in order that you may go away with something specific, and not with the feeling that this talk is nothing but generalities, I have selected a gas company as a concrete example of the profitable character of industrial gas.



EAST CHICAGO GAS COMPANY
TOTAL SALES OF GAS
and
GROSS & NET INCOME FROM ALL OPERATIONS
1920-1923
MILLIONS OF CUBIC FEET
THOUSANDS OF DOLLARS
20
18
16
14
12
10
8
6
4
2
0
-2
GAS SALES
GROSS INCOME
NET INCOME
INCREASE IN GAS RATES, EFFECTIVE MARCH 1, 1921
FIRST INDUSTRIAL GAS SALES, MARCH 1922
DECREASE IN GAS RATES, EFFECTIVE JULY 1, 1923
ESTIMATED
JAN
MAR
MAY
JUL
SEP
NOV
1920
1921
1922
1923

The gas company selected is the East Chicago Gas Company, located twenty miles from Chicago. I have selected this company for two reasons. First, that I know all about it, and second, for the reason that this company had a smaller gross income in 1920 and for many years prior to 1920, than any member company in this room. This particular property had a gross income in 1920 of $10,000, and its gross income for many years prior to 1920 had been $10,000. The year 1920 is shown on the chart for the reason that it is a characteristic year of the opertions of that property and it has not been selected because it was an unusual year or a favorable year for the purpose of this illustration. As I say, it was a characteristic year.

In the year 1920, we were selling in East Chicago, 800 B.t.u. natural gas, approximating 1,500,000 cubic feet of gas a month at 50c per 1,000 cubic feet and receiving a monthly income of approximately $800. The investment in the property was substantially $55,000, as shown by our books. The annual losses in operating the property without anything for taxes, or for interest or depreciation, were something over $7,500. In February, 1921, you will note that the income curve went sharply up, wheras the sales curve stayed flat—in fact, went down slightly. This was due to the fact that the sale price of 50c for natural gas with 800 B.t.u. was changed to $1.50 per 1,000 cubic feet, for the first 3000 cubic feet of manufactured gas, and then by graduated steps reduced to 75c per 1,000 cubic feet, for all consumption in the month in excess of 500,000 cubic feet. The B.t.u. of this gas was 550 B.t.u. and the gas was manufactured and pumped down to East Chicago from Chicago, over the same mains that had formerly supplied natural gas to the city of Chicago. In March, 1921, we started to secure industrial gas business. Our meters in East Chicago numbered approximately 400. There are no more meters there today, owing to the fact that we have lost some of the small consumers. The twelve months from March, 1921, to February 28, 1922, showed a profit of some $1,400. The next year showed a profit of $36,173; and based on the eight months of this year, the property will earn for 1923, $67,656. This is exclusive of interest and depreciation on investment. The investment in the property, as stated before, in 1920, was approximately $55,000, and today it is estimated at $125,000, or an increase of $70,000. With this increased investment of $70,000 the net earnings have been changed from a loss of $7,500 per annum to a profit of $67,000 per annum and we have just scratched the surface in adding additional profitable business in East Chicago.

It is true that this community is an industrial community, but it is also true that the propery, for many years, was operated at a loss, and that all of the industries to which this gas is supplied have been engaged in business in the community for many years and during all of that time could have used gas in their processes of manufacture. In other words, none of this gas has been sold to new industries coming into the territory. It must be that there are many of the member companies in this room who have situations very similar to the situation which existed in East Chicago. It is certain that you have not all of your industrial gas business, and such of that business as you have not added to your mains, you should, in your own interest, secure.

You are headed, as pointed out before on a previous chart, for a continuation

of losses on the average small consumer, and until our rates throughout the country are radically changed, I do not see how this can be obviated.

You, therefore, must, if you desire to preserve your balance sheet, secure profitable business which will make up for the losses which you are bound to have on a large number of people who will insist upon gas service which you, as a public utility, will be obliged to serve.

I hope, if you have not already done so, that you will attend one of the sessions of the Industrial Gas Section. You will be surprised with the ability of the men you find there, you will be fired with their enthusiasm, you will go back home and add some of this profitable business to your system, you will find that it will show up favorably on your balance sheet, and you will be rewarded for having attended this convention.

E. J. Stephany: I am sure that we all agree that we have listened to a most inspiring and instructive talk. On behalf of the section and of the Association, I wish to thank Mr. Munroe for his very fine address.

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS

Arthur Hewitt, *Chairman,* Toronto, Ont., Can.

The Committee appointed to consider the President's Address have the honor to report as follows:

"A broad and comprehensive review of the state and progress of the industry, the address of the President, Mr. R. B. Brown, contains many suggestive thoughts on a variety of problems to be met and points very directly to the necessity of concentrated effort on the part of company executives, officials and workers, first, in the direction of rendering perfect service and, also, in furnishing for the information of the public important facts regarding the industry as an antidote to the hurtful propaganda which is still being caried on against public service undertakings in various parts of the country.

"We recommend to the membership, as a whole, a careful perusal of the address of the President and urge that during the coming year heartiest local cooperation and support be given to the official efforts of the Association to secure for the gas industry a high place in popular esteem."

Arthur Hewitt, *Chairman,*
C. L. Holman,
H. A. Norton.

(Motion made, seconded, and carried that the report of the Committee on the President's Address be accepted and printed in the Proceedings.)

Mr. F. C. Weber, chairman of the Technical Section, upon invitation, occupied the chair during the presentation of an address, the contribution of that section, by Dr. E. W. Smith on the subject of

EXPERIENCE OF THE BRITISH GAS INDUSTRY UNDER THE THERM REGULATIONS

Dr. E. W. Smith, Woodall-Duckham and Jones, Ltd., London, England.

You have done me a great honor in asking me to deliver an address before your annual convention, and I have been considerably puzzled to find a satisfactory explanation as to why the lot should have fallen to me.

It was a source of great pleasure for me to have the privilege of speaking at one of your meetings in New York in 1920, and I have come to the conclusion that, as you are desirous that someone from England should talk to you for a few moments about English experiences, you may prefer to listen to someone you know, rather than to some one else better qualified whom you do not know.

Anyway the privilege is mine, and the suffering will be yours.

The subject of my address,—kindly decided for me by my friends over here—is "Experience of the British Gas Industry under the Therm Regulations." I am sure you will quite realize that it would be real presumption for me to attempt to speak on behalf of the British gas industry. I am neither a typical representative of the British gas industry, nor am I competent or authorized to speak for it. I have no doubt whatever that many of its members will differ from some of the views and conclusions I shall express today.

I feel, however, that I can give an unbiased account of conditions as I see them, and it is my pleasure to put them before you for what they may be worth.

If the subject be treated strictly as per title it will be necessary to discuss the effect of the therm basis of charge on gas manufacture, distribution, sales, and gas-burning appliances. This would also include the effect on the consumer.

The change has taken place so recently that it is quite impossible and certainly inadvisable to come to any definite conclusions as to what has been the effect of the introduction of the therm as a basis of charge for city gas. It may, however, be profitable to attempt to indicate what appears to be happening and to have happened in certain instances.

It will be readily appreciated that no quick changes can take place in methods of manufacture—particularly of a radical nature. Half-depreciated plant cannot, with profit, be dispensed with, whatever the inducements held out by newer systems—even if there were newer systems of coal carbonization or gasification which had prospects of giving improved results.

What can be considered improved results? In my view any system that enables the gas engineer to:

1. Give therms to the consumer at a reduced cost, and to

2. Supply therms under more constant conditions as regards pressure, calorific value and specific gravity, is one that is definitely in the line of progress.

Any interest you may have in what I am saying is certain to be far removed from a purely intellectual one. The question of the conditions of gas supply and gas rates is one in which you all have a vital and very practical interest. Your fundamental problems are practically the same as ours, although the detailed causes of the difficulties with which some of your undertakings are confronted are in the main very different from those with which we have been, and are still to some extent, confronted in Great Britain. Your statutory conditions are different. You have relatively very few municipally owned concerns. Because of the differences in the availability of raw materials your methods of manufacture are in the main very different from ours—but you are all desirous of supplying the cheapest and most satisfactory gas consistent with a reasonable return on the capital invested. It is conceivable, therefore, that the means that might conceivably meet with some measure of success in Great Britain for the alleviation of some of the difficulties of recent years in the British gas industry might not be so effective if it were possible to apply them to the American gas industry. You are in a much better position to judge of this than I am.

The position that has arisen in England will be better understood if I review—what many of you already know—that which has led up to the change from cubic feet to therms. It will then be seen how the sequence of events justified such a radical change.

The difficulty that arose in England during the latter part of the war and the early part of the peace was that, owing to the high price of coal and the cost of labor and materials, the cost of production, of even bad gas was so high that most of the dividends of statutory (privately owned) undertakings reached practically vanishing point, and many municipally owned undertakings were working at a loss because they were not allowed to sell gas at a price higher than the maximum allowed by Parliament. This meant that the companies were unable to raise fresh capital on satisfactory terms, owing to the depreciation in value of already existing shares. Most concerns were only able to keep solvent by supplying a poorer quality of gas than had been customary prior to 1914. The maximum price having been reached the only alternative was to maintain a reduced quality. This was only possible under a system in which gas was sold by volume. It may be asked—What about the legal standards for calorific value? As will be seen later these were considerably reduced for various reasons, and during the war many gas undertakings turned out very low calorific value gases indeed.

The state regulation of the British gas industry, pre-war, though reasonably effective, was extremely inconvenient and expensive. Any proposed alteration in the gas standards or the maximum, or standard prices, were only obtained by Act of Parliament, and after elaborate public inquiries. This procedure had to be gone through by each individual undertaking requiring a change, and in 1918 there was hardly a company that could have continued a sound financial existence if it had been compelled by the authorities to supply its gas up to its full statutory requirements.

The period just prior to the war was one of very rapid evolution in the gas industry in England. Prior to 1912 the calorific value standard of testing was non-existent, but in that year two of the smaller London companies substituted this test for the candle power standard, which with the rapid elimination of the flat flame burner was of very little value. This change and all such changes required an Act of Parliament until 1916, when the Board of Trade was empowered under certain circumstances to substitute a calorific standard for an illuminating standard. These conditions held until the 1920 Gas Act was passed, which gave us the therm basis.

Prior to 1914 it was noticed in some areas that even though gas was being supplied up to standard the practical results obtained in use were becoming less and less satisfactory—but between 1914 and 1917 the general standard of gas quality rapidly fell, and the adverse results—as regards increased consumptions per unit of operation—both domestically and in industry—were very marked. In Sheffield there came into being a very active gas consumers' association which, with the railway companies, who are large consumers of gas—gave much publicity to the hardships under which consumers were laboring.

Gas undertakings labored under great difficulties. They were expected to strip their gas of benzene and toluene, which reduced calorific values up to 30 Bt.u.'s per cu. ft. There was a scarcity of suitable coal. There was a shortage of skilled labor, both for manufacture and repairs. This tended to still further reduce the calorific value of the gas as the percentage of nitrogen, carbon-dioxide, and even oxygen went up to previously unheard-of figures for city gas.

The munitions concerns that depended largely on gas supplies soon made their voices heard, but the domestic consumer stoically put up with worse results as one of the minor difficulties of the war.

In 1917 the Fuel Research Board, under the direction of Sir George Beilby, were requested by the Board of Trade to report as to:

"What is the most suitable composition and quality of gas and the minimum pressure at which it should be supplied, having regard to the desirability of by-products, and the purposes for which gas is now used?"

After very full inquiry, in which representatives of the gas industry, the consumers, and others were taken into the closest consultation, the Fuel Research Board made its recommendations.

Too much praise cannot be given to Sir George Beilby for the broad gauge way in which he handled the whole matter. He had a very difficult problem to solve and the easiest way was certainly not that of pacifying all the interests concerned. However, he achieved the nearest approach to that desirable end of any recommendations that come readily to one's mind.

The gas industry was fretting under irksome restrictive legislation. They were demanding much greater flexibility of regulations—but at the same time did not desire that the consumers' interests should be less protected. It was forcibly urged by them that the chief interest of the gas industry was a greatly extended increase in the use of gas, and that this could not be brought about if the gas industry did not fully serve the interests of the consumer.

It has been recently pointed out, however, by Sir George Beilby that as con-

sumers are for all practical purposes entirely dependent for the protection of their interests on the conditions laid down by Acts of Parliament, one of the first considerations in fixing any new standards of quality and value must be that this protection should be strengthened, not weakened. If this is secured, then, as regards the need for the adoption of cheaper and more efficient methods for the production of gas, the interests of the consumers are practically identical with those of the producers, for cheaper gas can only be secured by the adoption of improved methods.

Cheap and ample supplies of gas are, however, not only a benefit to the individual consumers but to the nation at large. Viewed, then, from this common ground, it was clear that all the interests concerned would best be served by giving to the gas undertakings the utmost possible freedom in the selection of the cheapest and most efficient methods of production.

Having these issues clearly before them, the board were in the position to proceed with the development of a concrete scheme, which, whilst safeguarding the interests of the consumers, would give to the gas undertakings the manufacturing freedom which they desired.

On the technical side, consideration had to be given, not only to process changes which were already in sight, but to those which might result from researches known to be in progress.

Experimental work showed that within a very wide range of calorific value one B.t.u. was as good as another, subject to the consumers' apparatus being suitably adjusted.

It was, therefore, concluded that from the consumers' point of view there is no objection to the granting of a wide margin of elasticity to the gas undertakings in their selection of the standard calorific value which will best suit their manufacturing policy. Having settled this fundamental point the board had to consider the new conditions which would need to be imposed on the gas undertakings for the adequate protection of the consumers.

There was an insistent demand on behalf of the consumers that the allowable percentage of inert constituents should be restricted. Others desired to restrict the carbon monoxide content of the gas supplied.

It can be seen that, having come to the above conclusions, it was a natural step to recommend that gas should be sold on a heat unit basis. The gas industry maintained that when gas is sold by the 1000 cu. ft. of standard calorific value that it was being sold on a heat unit basis. There is no doubt there is much to be said for this contention, but it must be remembered that in many districts the arrangements for independent testing were very unsatisfactory, and these could be much more easily overhauled and improved if completely new and more comprehensive regulations were introduced which would necessitate the carrying out of regular independent tests on all gas supplied.

The therm basis, therefore, came as a natural sequence as a recommendation of the Fuel Research Board.

The recommendations can be summarized as follows:

That the consumer shall be charged for composition or calorific value.

That the consumer shall be charged for the actual thermal units passing through his meter.

Gas undertakings to be free to deliver any mixture of gases free from H_2S and not containing more than 12 per cent of inert constituents.

Gas undertakings to adjust appliances to burn gas supplied with safety and efficiency.

The pressure of gas shall not be less than 2 in. W.G. at outlet of consumer's meter.

Special conditions shall apply to bulk supplies of industrial gas. It will readily be appreciated that these recommendations constitute a revolution in the conceptions one had of the conditions of the sales of gas.

The limitations of inerts in city gas to 12 per cent was strongly opposed by the gas industry, as was the position for determining the minimum pressure of 2 in. W.G. at the outlet of the consumer's meter.

The Gas Regulation Act (1920) was based on these recommendations.

Summarized, the Act provided:

1. For the sale of gas on the heat unit basis—the Therm.

2. The Board of Trade was empowered to authorize—under specified conditions—any requirements of a gas undertaking relating to calorific value.

3. That the new standard or maximum price to be fixed by an order shall correspond with the old one with such additions as appear to the board reasonable to meet increases if any due to circumstances beyond the control of the undertakers since July, 1914.

4. The order may modify the provisions relating to rates of dividends dependent on price of gas.

5. Gas undertakings shall assume responsibility as to the efficiency of existing apparatus in so far as such efficiency is affected by changes in declared calorific values.

6. That the gas shall contain no H_2S.

7. That the gas shall be supplied at an efficient pressure in the mains of the undertaking.

8. The act provides for systematic testing of the gas for C.V., H_2S and pressure—by independent authorities.

The Act also gives to the Board of Trade power to make special orders on the application of gas undertakings and specially extends this power to the Metropolitan gas companies.

The following are matters with which the Board of Trade may deal by special orders,. viz:

a. The supply of gas in bulk.

b. The separate supply for industrial purposes.

c. Authority to local authorities to supply gas outside their district, etc.

d. Authority to purchase by agreement and for joint working or amalgamation of undertakings.

e. Establishment of superannuation, pension and other like funds.

f. Raising of capital and borrowing of money.

g. Purchase, redemption, and cancellation of debentures, etc., or obsolete or unproductive capital, or capital not represented by available assets.

Briefly, it may be said that the procedure for obtaining a special order under this act consists of publishing notices containing particulars of the order for which application is being made and inviting objections thereto.

The Board of Trade must then consider all objections made and, if they think fit, hold an inquiry. As a result of the inquiry, special orders made by the board are laid in draft before both

Houses of Parliament and must be approved by resolution of both Houses before they become law and are deemed to have the powers of a special act.

It will thus be seen that the act, while carefully guarding the interests of the public and the consumer, has simplified the process by which gas undertakings can obtain modifications of their statutory powers. It is no longer necessary for them, as a rule, to promote a private bill at great expense or use the complicated procedure necessary for obtaining a provisional order.

It will be noted that the chief differences between the recommendations of the Fuel Research Board and the Gas Act relate to

1. The position at which minimum pressures shall be taken.

2. There is no limitation as to "inerts" in the act, nor to the percentage of CO allowable but provision was made for inquiries into these matters on which future legislation—if any—could be based.

These inquiries were held and will be mentioned later in my address.

From what I have already said you will be in a position to realize to some extent what were the factors that brought about the change from cubic feet of standard calorific value to therms—as a basis of charge for gas.

I shall endeavor in the remainder of my address to put before you some of the effects of the therm basis in England. It must be appreciated, however, that I am far from claiming infallibility for the judgments I have endeavored to form, and the act is so comparatively young that, at this stage in its infancy, it is impossible to draw any definite conclusions as to the influence it will have on the operations of the industry which it so immediately affects.

I have made it my business, however, to discuss the subject of this address with a number of representative gentlemen who are closely in touch with various aspects of the question.

Among these may be more particularly mentioned Mr. Honey, the Gas Administrator at the Board of Trade, Mr. Fottrill, Manager of the National Gas Council, various consulting gas engineers and one or two managers of municipal undertakings. To these gentlemen I am indebted for most valuable and interesting discussions.

Nevertheless, they are in no sense responsible for the views stated here, although I have no doubt they are most of them in general agreement with what I have to say.

It must be remembered that when the 1920 Gas Act came into force costs were about as high as they had ever been in the history of the British gas industry. As the new therm prices were to correspond with the old thousand cubic feet prices, except for suitable adjustments for enhanced costs of production due to rises in costs of materials, labor, etc., and changes in returns for residuals, it was natural that the managements of the company undertakings whose dividends had been depleted should seek to immediately avail themselves of the new act by making application to come under the therm basis. Those who did this early had a distinct advantage over those who postponed the event, because during the last twelve months costs generally have rapidly fallen. The act, however, provides for cases where too high dividends are being paid through such changes in costs of production which are outside the control of those

responsible for manufacture and consumers have it in their power to obtain adjustment in all such cases. It is generally recognized, however, that cheap gas means more business and enhanced stock value, and there is little likelihood that the larger cities will take undue advantage over a long period of the inequality of treatment meted out to those who adopted the act early as compared with those who adopted it late—except perhaps in some of the smaller undertakings in which there is *thought* to be little chance of obtaining relatively large increases in gas outputs. It is notable that there are many undertakings that are charging less for gas than their dividends would indicate.

There are many municipal undertakings that have not yet adopted the act. Most of them have been late in doing so. It is natural this should be so. In the main these undertakings do not aim to make a profit. Their sole concern should be to sell cheap gas of good quality. The therm inquiry delayed some of them and some saw little or no advantage to municipal undertakings in the therm basis of charge. However, there is no disadvantage and they will all soon be roped in.

The tendency at first was for undertakings to apply for much lower calorific values than were customary pre-war. This was due partly to the condition of plant, quality of coal, and possibly also to a lack of appreciation of the implications and consequences of the new basis. With improved quality of coal, the execution of renewals and repairs, there is a distinct tendency in many cases for the declared calorific values to rise rather than fall. The value of the new basis lies in its flexibility in that engineers may as a result of their accumulating experience send out that quality of gas that they can deliver to the consumer at the lowest cost *per therm*—not per thousand.

During the latter part of the war, and later, certain individuals advocated the production and distribution of various mixtures of gas and air, producer gas, coal-gas, blue water gas mixtures, complete gasification gas, etc., having calorific values as low as 200 B.t.u.'s per cubic foot, largely on the grounds that (1) such gas could be made at a very much reduced price per therm, that (2) it was possible to bring about improved aeration of such gas in atmospheric burners, and that (3) it was in the direction of greater fuel conservation. There are no signs that this excellently organized campaign is meeting with the success that the energy expended would appear to warrant. The most promising of these proposals—complete gasification—has so far failed in its general application because (1) few gas coals can be used for complete gasification, (2) when they can be used satisfactorily the cost per therm shows no advantage over some other well tried systems. In fact the new *therm* basis—giving as it does the "knock out" to the "volume" basis—destroys the chief attraction most of these proposals had for many gas engineers.

The Fuel Research Board originally proposed a limitation of inerts. There were those who strongly objected to any limitation. There is no need for limitation of inerts now that the therm basis has been adopted, because the whole of the advantage that is gained in some systems by the reduced price per therm *into holder* is lost owing to increased costs between the holder and the consumer's burner, due to the attenuated calorific value of the gas and its much increased specific gravity. It is

often insufficiently realized that it costs more to deliver and sell gas to the consumer than it does to make it on the works and that the cost of the freightage of gas from the works to the consumer's premises on a therm basis, is proportional to the volume occupied by the therms sold and the weight of the products supplied. High calorific value gas has a specific gravity of—say—.45. Low calorific value gas may be double this figure. High C.V. gas has also a proportionately smaller volume than low C. V. gas. High C. V. gas means greater capacity of holders, governors, mains, services and meters. It means greater regularity of district pressures, and lower boosting costs. All the signs are that taking a long view the gas that can be delivered at the lowest cost per therm at the consumer's burner is a gas of high calorific value—say, over 500—rather than of low calorific value—say, lower than 450. No hard and fast figure can, however, be discussed. In general, any figure that might prove a good standard for the average English undertaking would, with the same plant, etc., have to be reduced by up to 50 B.t.u.'s in Scotland where the quality of available coals would account for this difference in calorific value—assuming the same efficiency of manufacture.

It is difficult to be anything but misleading. One notes that engineers can prove conclusively that 400 B.t.u's gas will give the highest efficiency of manufacture, but that same engineer is equally convinced as to the efficiency of manufacture with 450 B.t.u.'s gas, after he has completed the repairs of his carbonizing plant and the price of gas oil has dropped somewhat. Fortunately the Gas Act allows for this flexibility of view, and the declared C. V. may be suitably increased. There is now less and less discussion in England as to what C. Vs should be generally adopted. It is recognized that there can be no uniform standard. Each undertaking has its own peculiar set of conditions of manufacture, and it is for each to determine the most efficient way of working under these conditions, it being recognized that efficiency in manufacture is not the whole story. There must be an overall efficiency to include distribution and use.

The therm basis has had an enormous educational value, not only for the consumer but more particularly for the gas industry.

Gas engineers are still out to produce maximum profits, but the basis for such profits has been somewhat changed. The therm basis as such has not brought about this broadened outlook but it is rather due to the compulsory effect of having to change one's perspective. There is no doubt in my mind that there was nothing to prevent any of the improvements that have taken place—occuring under the old cubic foot and declared C. V. basis of the pre-1920 period. The therm still depends on the meter and the calorific value test. There is only an academic value in reducing all gas sold in all undertakings to the same common denominator. No juggling with figures will reduce all gas to the same price per therm nor will the reduction to the therm basis, give even a rough idea as to why one gas in one locality is sold at a different price from another gas in another locality.

The Gas Act (1920) on the contrary—apart from the question of the therm—is a most progressive step for the gas industry and there is no doubt that, by the employment of the therm, gas undertakings can more conveniently alter their

declared calorific values without altering the actual price per unit to the consumer. There would have been little difficulty, however, in changing the price per 1000 cu. ft. to correspond with any change in declared calorific value—and perhaps the consumer would be better satisfied if for each drop in calorific value he were given a corresponding reduction in the price per 1000. Under present conditions of the therm basis notice is given that the gas undertaking intends to reduce the calorific value and the price per therm will in most cases remain unaltered. The psychological effect is not so good.

You will all have read about the therm inquiry that was held earlier in the year. This was demanded by the press and general public. Later the gas industry supported the demand. There was no doubt that some of the electrical interests engineered this campaign and one section of the press was known to be after the advertising orders of the electrical concerns. As a consequence largely of the press campaign, the general public strongly supported the demand for a public inquiry. Complaints of increased gas accounts were numerous but these came from all districts indiscriminately—districts where the therm had been adopted and districts where it had not been adopted. Consequently the troubles—in so far as they had any real existence—could not have been due to the adoption of the therm.

To what were increased gas accounts possibly due? In this connection it should be remembered that most gas-consuming apparatus in use are of fixed consumption and are not usually regulated. Take for example the incandescent mantle and the gas fire. At fixed times these are turned on and off—i.e. when light or room heating are wanted. They are rarely regulated. They are usually full on or full off. Within certain limits—if more or less light and heat are given per minute than usual—it is not noticed. If the pressure of gas is increased, a greater volume is consumed per hour. If the gravity is reduced, a greater volume will be consumed per hour. If the calorific value be increased, the specific gravity of coal gas will almost invariably be reduced so that with the same pressure the number of therms delivered will be increased, not only because of the increased calorific value of the gas but also because of its reduced gravity.

The tendency during the accounting periods, in question at the therm inquiry, was to improve the service given to the consumer. Calorific values were increasing, specific gravities were going down, and pressures were increasing—and the consumer did not realize that he was getting correspondingly better service in improved lighting and pressures.

It is on record that one large undertaking in England experienced a definite increase in output as and when the calorific value of the gas was increased and the specific gravity of the gas was reduced. Some will claim that this is direct evidence that the higher calorific value gas is less efficient in use. In some cases this might be so—particularly where the higher calorific value is above 550 B.t.u.'s. In this particular case the efficiencies obtained were similar before and after the increase.

The committee entrusted with the therm inquiry reported that after careful consideration of all the evidence available they were unanimously of the opinion that the method of charging for

gas on the basis of its heating properties, i.e. by the therm, is the best safeguard of the consumer.

"It is abundantly clear that the system of measurement by the therm, as such, can in no way affect the price, composition, quality, pressure or supply of gas. It is a mere method of measurement and can have no active results."

They recommended that the therm basis be applied to all statutory undertakings within the scope of the act and that the consumer should be supplied with the fullest information relative to the volume, calorific value and therms of gas consumed.

Besides the inquiry into incombustibles the Gas Regulation Act (1920) provided for an inquiry into the question whether it is necessary or desirable to prescribe any limitations of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes.

The committee reported—as far back as January, 1921—that subject to all practicable precautions being adopted in the use of suitable fittings and subject to towns gas retaining its distinctive odor—"it is not necessary or desirable to prescribe any limitations of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes."

This did not satisfy everyone however, and there was an active press campaign led by some scientific men who should know better which gave much publicity to the convenience of coal gas containing carbon monoxide as a new world accelerator and as a consequence the number of suicides by gas poisoning appeared to increase.

This has nothing to do with the therm—directly—but as most of the vicissitudes of the British gas industry since 1920 may be said to be indirectly due to the therm, I am mentioning it. It is obvious that the therm has as little to do with this matter as with most of the other matters I have mentioned.

For decades the gas meter, most unjustly, has been looked on as a "Mechanical Ananias" by gas consumers. A very small percentage understood how gas is measured. Fewer still knew what was meant by calorific values or B.t.u.'s—any more than they understood electrical units. Any change of "unit" was sure to create suspicion in the minds of consumers and one of the most valuable lessons the last two years have taught us is that no gas undertaking can afford to neglect the education of the general public in matters of mutual interest. There has been too great a tendency to envelop one's undertaking in mystery and to come out into the open only when the undertaking is in difficulty.

Gas undertakings are public service—owned directly or indirectly by the general public—and the general public will respond to the advantage of gas undertakings, if they are taken into the confidence of the gas undertakings both in times of sunshine and in shower. Many of our gas undertakings have learned this lesson.

One of the weakest parts of the Gas Regulation Act of 1920 concerns the section relating to testing for calorific value. It was intended that this should be done by means of recording calorimeters. It was soon realized that there are no such instruments that can be relied on for an accuracy which is within the penalty limits allowed by the act—unless very frequent check tests are carried out.

Professor Boys has recently demonstrated an instrument which is the best of its kind, but I doubt if there are half a dozen men in England, other than Professor Boys, who could guarantee the accuracy of its readings over a period of thirty days. I am fully aware that precision can be carried too far for practical purposes as even if a perfect recorder were available it would not be capable of giving more than the equivalent of a large number of spot tests at a given point on a given main. It could not take into account fluctuations in the amount of gas passing through the main and consequently it would not give a true average calorific value of the gas either sent out from the works or supplied to the consumer.

The regulations concerning gas examiners are altogether inadequate. There is no definition as to competence and as almost anyone may become a gas examiner both gas undertaking and consumer are bound to suffer.

More regular testing by an independent authority—even though unreliable—necessitates a closer watch on one's own tests, which have increased in number, type and reliability.

In conclusion, you will have appreciated that I am no enthusiast propounding the *direct* advantages of the therm basis. It has given many *indirect* advantages to both the consumer and the gas industry,—but its adoption was only warranted by the very special conditions and chaos that held in Britain at the termination of the war.

Gentlemen, it has been a delight to have the opportunity of addressing you. I only hope I have justified your selection of me for the address.

F. C. Weber: I am sure we will all profit very much by this very valuable information that Dr. Smith has given us. On behalf of the Technical Section, and the Association generally, I want to thank him very much for coming so far to give us this illuminating information.

The President: Gentlemen, it will interest you all, I know, to hear that this is the 50th anniversary of the first organization of the American Gas Association. We have in our present membership many of those fathers of the industry whom we still delight to honor and revere, but I do not see in the audience more than one man whom I personally can recognize as having been connected with the industry at that time, although, as I say, we have many members who may not be present here but are still identified with the industry.

Mr. Charles H. Nettleton of New Haven, I believe, is the only man here identified with us at the time of the inauguration of the American Gas Association which held its first meeting in New York on April 16 and 17, 1873. If there are any others, I hope that they will be with us a good many years, as I am sure Mr. Nettleton will.

The president then invited Mr. J. W. Heins, chairman of the Accounting Section, to occupy the chair during the presentation of an address on behalf of that section by Mr. P. H. Gadsden on the subject of

PUBLIC RELATIONS—THEIR IMPROVEMENT THROUGH GAS COMPANY PERSONNEL

P. H. Gadsden, Vice-President, The United Gas Improvement Company,
Philadelphia, Pa.

As we come to these meetings year after year, we are impressed with the fact that at each meeting some one or two questions stand out prominently, demanding and insisting upon more attention than others. Looking back over a period of fifteen or twenty years, I think it is possible to notice a distinct trend from these questions showing the development of the industry during that period from the scientific and the technical to the commercial, from the mechanical to the personal, from the machine to the man behind it.

The future of the gas business, as of all public utilities, is going to depend, in my judgment, largely upon the use which we make of the great body of our employees, and to what extent we utilize this body to educate and inform the public as to the problems which confront them.

The gas business, like any other business, may be considered broadly under two heads: Manufacturing, including distribution, and sales. The manufacturing end calls for the services of highly trained engineers and chemists. It is a business of specialists. Its problems must be worked out by mathematical formulae and its answers must be mathematically correct.

The selling end, while it has its own principles and policies, is not so dependent upon scientific formulae. Its problems, from their very nature, do not lend themselves to a solution by a slide rule, for instance. They cannot be mathematically accurate. They cannot be laid down in advance. They depend largely upon the human factor. Their solutions—the satisfactory relations of a company with its public—are dependent upon the personal relations of the individual to his community and to the consumers themselves.

Now, as I see it, one of the great mistakes that we have made in the gas business, as in all other public utilities, is that for too many years we have concentrated the spotlight of our attention too exclusively upon the scientific and technical side of this business, to the neglect in a good many instances of the commercial side. We have been so intent upon improving the processes of manufacturing and distribution, in giving the very finest class of service to our consumer, that we have in a measure overlooked the fact that outside of the manufacturing end there lies a broad region bristling with troublesome questions, which come under the head of public relations. We are just now beginning to wake up thoroughly to that fact.

No better proof of the thought which I am suggesting, it seems to me, could be advanced than the fact that at this meeting, when the gas business is over a hundred years old, we are deliberating and seriously debating how we are going to get away from this rigid scientific rate structure, how we are going to sell our gas in volume to the public.

It ought not to be necessary in an industry as old as this for us at this late day to have a mass meeting to decide what kind of prices we ought to put on our product, and yet that is what we are doing. We all want to sell industrial gas; we want to sell it in great volume, and we find that the commercial end of our business has got us hamstrung; we can not do it.

Now, whose fault is that? Not the public's, not the public service commissions'—our fault. We never studied the problem; we took for granted that all gas looked alike, smelt alike and cost alike, and that shows that our commercial instinct has not been sufficiently educated. We are good engineers; we are good chemists, but when it comes to selling the stuff, we have not paid the attention to that line that any other industry has.

Do you know of any other industry that waits until after it has been in existence forty or fifty or sixty or seventy years to work out a price for which it can sell and make some money? Every other industry I know has fixed the price first. And I say "fixed" because we fix these prices; we fix the principle underlying them; nobody else does.

Now, I want to throw that out as a suggestion, a thought in my mind, that we public utility people have got to get into the selling game and all that it implies; we have got to learn to be salesmen, not only of gas and gas appliances—why it is no trick to sell a commodity which is a necessity of human life to a customer who can not buy it from any other competitor; that does not take any salesmanship; anybody can do that—but the great selling problem that we have is not selling the gas, not selling a range or a water heater, but selling our service to the community we serve.

It is entirely possible for us to give such fine service that each individual consumer will be satisfied and yet the gas company not enjoy the good will of its public. Our problem is to deal with the public collectively as well as individually. We must deal with this intangible thing known as public opinion.

Some men, and a great many men, think that if you give good service at the proper price that is all you have to do and you are entitled to good public opinion. Well, you are not. You have not done anything more than you have been paid for. What your consumer pays you for is good gas service, but if you want his good will and his good opinion you have to do something beyond that; you have got to inject into this business of ours the human touch, the human equation; you have got to make him feel that we are here to serve him, not only in gas but in every way that goes to the upbuilding of the community.

And how are you going to accomplish that? Well, certain it is that you cannot accomplish it by individual effort. It is not a one-man job. It is not the job of a specialist. It is not necessarily the job of a technically trained man, although the better training he has the better equipped he is for any job. This is a problem of human contact, of human touch.

Now, no one man or set of men can

make enough personal contacts in your community to accomplish this purpose. It requires mass action. And, fortunately for us, we have the machinery right at our hand in the great body of gas employees throughout this country whom we have largely ignored, because dealing with the mechanical and the technical problems it is impossible to explain to them the intricate questions involved. We had simply to give them a decision and tell them to put it into effect.

But this question of public relations opens up a tremendous field for the employee. It is only through him that we are going to accomplish our purpose. In the eyes of our gas consumers, who represents the gas company? Not you and I; they do not know us; they see your name in the paper once in a while, but the gas man in any neighborhood is the meter reader, or the fitter, or the trouble man, or the girl at the switchboard whose snappy replies can do you more harm than you can undo in a year, the man or woman in the cage who takes the money—that is the gas company.

You talk about public relations—those are the people from whom they get their conception of our policies. Of what use is it for the president or vice-president of a great corporation to lay down policies on public relations and then have his subordinate officers follow the old plan? Why, you do not get anywhere. You have got to start in from the bottom up. And the wonderful thing about it is that it opens up this great big, broad field for the man behind the gun, for the man in the ditch, to work out what has come to be recognized as the essential policy of public utilities.

Unless we can utilize this force effiently and practically, we are not going to solve these public questions that now confront us. They are incapable of solution by individual effort. You have got to throw against that great body of misinformed public opinion an equally great body of zealous and eager, well-informed employees, and when you do it these questions which trouble us will begin to disappear.

How are you going to do that? How are you going to get a body of employees into a mental attitude such that they are going to go along with you and are going to cooperate? Why, in the first place, we have got to change radically our mental attitude toward them. It is a question of psychology. If he is only a hired man, he is only going to do what he is paid for. When we begin to make him realize that he has just as essential, just as important a part in this great problem in the gas industry as we have, we are going to make a new man of him. When we take him into our confidence and explain to him these questions of rate structure, not in a technical way—because after all the people who put them into effect are not technical men—but explain to him in the same way that we explain to our consumer; when we explain to him this question of industrial sales, what it means to the public, what it means to the gas company, what it means to the individual gas consumer in the way of ultimately reduced rates, why he will pass it along.

Every time he goes into a house today he is asked dozens of questions about the gas company. You know the housewife asks him questions which the president of the company could not answer. Well, now, what is he going to do? Why, we send the poor devil there absolutely unprepared, do we not? We do not tell him anything. We put him in a position where he appears to the public as an ignoramus. Well, he is nothing of the

kind. He has simply been neglected. He has not been told of the things that he has a right to be told, because he is our ambassador in the court of public opinion, and it is a bet which we have overlooked too long.

Now, I say we realize that now, but are we going to undo what we have done? How are we going to get this body of men whom we have so largely neglected, whose potential power for the creation of public opinion we have overlooked, how are we going to get them going along with us? We are going to get them by introducing into the gas business the human touch. We are going to pay a little more attention to spiritual values and a little less to the material ones. That is the way to get a man. He is the same kind of a man as we are—open to the same approach. Make a spiritual appeal to him. Call him in and tell him of your troubles, explain this vision that I am suggesting that is opening up to the employees of this country, that they and they alone can solve this public utility question. And what happens? Why, that man thrills with a sense of comradeship. He is no longer just a mere job holder. He is no longer just a hewer of wood or carrier of water. He recognizes himself as an essential factor in one of the great national industries of this country, which is rendering an essential service to over forty millions of people.

And what is that going to do with any man who has a soul? Why, it is going to make a man out of him just like it has made out of you and me. It is going to improve the importance of his own job in his own eyes and in those of his family and friends. He is going to cooperate, and he is going to take an active interest in the things which up to this time have passed over his head. It is going to dignify his job and, best of all, it is going to democratize the gas industry.

J. W. Heins: Gentlemen, I know you all agree that this promise of the section that you would get a very interesting and instructive talk from Mr. Gadsden on this subject has been carried out. On behalf of the Accounting Section, Mr. Gadsden, I take great pleasure in thanking you most sincerely for your kindness in coming here and addressing us today.

The President: Gentlemen, this concludes the last General Session of this very successful convention. I thank you for the fidelity with which you have attended the sessions.

(The president then declared the Fifth Annual Convention adjourned.)

PUBLIC RELATIONS SYMPOSIUM

Wednesday Evening, October 17, 1923

PUBLIC RELATIONS SYMPOSIUM

Wednesday Evening, October 17, 1923.

(Musical selections by the Madrigal Singers.)

The President: Ladies and gentlemen of the American Gas Association: Since we are meeting in the sovereign state of New Jersey, and since we are to hear from a number of gentlemen who represent the Public Service and Public Utility Commissions of our several states, it seemed that it was eminently proper that I invite the Honorable Harry V. Osborne, President of our Public Service Commission in New Jersey, to preside at this meeting. I did—he accepted—he is here. President Osborne.

Hon. H. V. Osborne: Needless to say, it gives me great pleasure to preside at this meeting, and I consider it a great honor to be asked to do so. On behalf of my fellow commissioners of New Jersey and the people of this state, we welcome you to Atlantic City.

This convention seems somewhat like a convention of the utility commissioners, we see so many of our fellow members here, and upon looking over the program it seems very much as though the subject of the evening, "Public Relations," was quite characteristic. What a familiar sound that has; in fact, we have heard so much of it lately that we might almost imagine that we could run our utilities on public relations, the satisfactory kind, of course, without regard to rates of return, valuations, complaints and the other incidentals that sometimes disturb the commissions. Of course, whether they disturb the utilities as much as they disturb us is another question—I will not attempt to answer that.

Your secretary-manager has handed me the program of the evening, so that all I have to do, really, is to read this paper to you.

I find that the first address scheduled has as its topic, "Public Relations from the Public Standpoint." It just occurs to me to interpolate a moment and suggest that if anybody in the world can understand what "Public Relations from the Public Standpoint" means, they must be very acute, because, ordinarily, those of us who come in contact with the public have very considerable difficulty in finding out just what the public standpoint is at any time, on any subject connected with the regulation of utilities. Of course, we commissioners appreciate that more than some of the rest of you do, perhaps, because we get it going and coming.

I am quite sure, therefore, that after you have heard the Honorable Alexander Forward, Vice-President of the National Association of Railway and Utilities Commissioners and Member of the State Corporation Commission of Virginia, you will agree with me that he is a gentleman of courage and that he has chosen his subject wisely.

PUBLIC RELATIONS FROM THE PUBLIC STANDPOINT

HON. ALEXANDER FORWARD, Vice-President of the National Association of Railway and Utilities Commissioners.

I AM HONORED by this invitation to address an organization that has made for itself a high place among those who would serve their fellow man. Your record of constant study of higher standards of service, your researches, your publications, the tone and tenor of your meetings, reflect something greatly more than material success, and demonstrate that I have paid you no empty compliment.

We are all now agreed in our estimate of the importance of maintaining excellent relations between the public utility and the people whom it serves. We know that the utility executive today is measured as much for his attitude toward public relations as for his mastery of the business or his ability to direct its course.

Possibly we do not always apprehend in how many ways the public mind influences the situation of our utilities. The subject is much larger than politeness across the counter of the business office and earnest endeavors to deal frankly and sympathizingly with the individual complainant, important as these are. Let us view the situation through the spectacles of the individual consumer.

There is no danger that any one of us will ever forget that an essential to public favor is service. Most true it is that the service may approximate perfection for years with little attention from its beneficiaries, and a single lapse may bring down maledictions. All of us have seen utilities which enjoy public approval very largely because they have improved greatly over the service rendered by a former management or under different conditions. But may I be permitted to say that if there is a utility rendering service over long periods approximating 100 per cent in efficiency, whose customers are not made aware of their good fortune, the publicity department needs attention.

It has been commonly said that the most powerful weapon developed by the World War is propaganda, and that word has come to have a rather reproachful flavor. Quite unjustly so, for appeals for Japanese earthquake relief and campaigns for our charities and our churches' programs are all legitimate propaganda. When I, as a patron of a utility, read in my daily or weekly paper, intelligently written advertisements concerning the practical uses of gas, its convenience and cleanliness, economy in its consumption, etc., I am impressed unconsciously with a feeling that my interests as a customer are being looked after. When I think, as do so many consumers, that I am being made to pay for air forced through the pipes instead of gas, I perhaps recall the advertisement in which the real situation was explained, and my complaint is abandoned or deferred. If I have ground for complaint, or think I have, which, mark you, is exactly the same thing from my standpoint as a patron, and I find that I receive careful and sympathetic hear-

ing, and a correction or a sensible explanation, my mind is at rest, and I do not add to the mail of the state corporation commission.

In Virginia, it is the motto of one gas man that one cannot begin too early with public education. He goes into the high school and tells the boys and girls, whom he knows will be the citizens and home makers of tomorrow, about the uses and advantages of gas. So when my child hears it, there has been made an indelible impression, and the investment in time and thought is likely to be repaid manyfold.

Every utility must deal constantly with its municipal government in securing, renewing and amending franchises, in the occupancy of streets, in matters of taxation. When the utility corporation has rendered good service, and has not failed to apprise the people of that fact, when it has been frank and open, when the attitude of its employees in the office and in the homes and on the streets has been courteous and thoughtful and sympathetic, I, as a citizen-customer, am unlikely to encourage my alderman or councilman in an attitude of blind hostility to the corporation. But if the service has been deficient, or if I have been made to feel that it is the fixed conviction of the company's management that the complainant is always wrong, and if I have been neglected by the advertising and publicity department so that I believe the utility has no interest in me save the collection of its bills, my attitude, expressed to my official representatives, will be critical.

This is no mere theory of which I speak. All of us who have had experience in public regulation, have had many opportunities to see how the success of a public utility in securing fair treatment at the hands of governmental bodies is in direct proportion to the care it takes in its public relations, and the attitude that it maintains toward the people whom it serves.

We could, any of us, cite examples without number, and it is not sufficient that there should be a mere standard, mere employment of publicity men—it is essential that the situation should be at the heart of the management, that the management and the executive should thoroughly believe in this as a matter of principle.

Yesterday afternoon I went into your meeting—your sectional meeting on publicity and advertising—intending to look in for a few minutes—and I stayed three hours, and was well repaid for every moment of it. And that little dispute to which the chairman, Mr. Mullaney, referred in the general meeting this morning, when analyzed, demonstrated that everybody was right, strange as that may seem. It was merely that they viewed the situation from different standpoints, and the meat of the proposition was that it is essential for the executive to furnish the material upon which the publicity must be based. And if there is any good reason why the public cannot be educated in any given community about any given utility, then there is room for the state committee, or the local committee, to find out where the trouble is, because the publicity man cannot make publicity unless the spirit is behind the written word.

If I am a stockholder, and my friends and neighbors are stockholders in the utility, we are likely to look after these matters of public relations ourselves, because we, above all, realize their importance. Customer ownership will do more than anything else to cure the mistakes

of utility management and to assure proper and just treatment at the hands of councils and commissions and courts.

In the main I have stated truisms. Public relations no longer occupy a minor position in the administration of the public service: The problem deserves and now receives the best thought of the best minds. The utilities enjoy a superior position in the philosophy of life, which is to help make each generation, each year, easier and more worth the living. Could any organization have a more inspiring purpose?

Hon. H. V. Osborne: I suppose it must be enlightening for you gentlemen, who are so fraught with difficulties and so overburdened with regulation, sometimes even perhaps annoyed by it, to get the point of view of the regulators, and particularly when you are able to get it from such widely separated geographical units, so that you can weigh it carefully and see what, after all, it may amount to.

The next speaker on this general topic will address you on "Publicity and Public Relations"—the Honorable W. D. B. Ainey, Chairman of the Public Service Commission of the great Commonwealth of Pennsylvania.

PUBLICITY AND PUBLIC RELATIONS

Hon. W. D. B. Ainey, Chairman, Public Service Commission of the Commonwealth of Pennsylvania.

It does my heart good to have this very great privilege, through the courtesy of your organization, to be present and participate with you tonight.

I am invited to speak to you on this general subject of public relations. I do not remember the particular title, and it is not important for the reason that I should not stick to it even if it were specifically designated.

I am gratified that in a general way this has found place upon your program, and I have felt it a great privilege to listen to my distinguished friends from an adjoining state present the subject in such a clear way to you tonight. And I am further gratified that you, in your separate organizations underneath your state organizations and otherwise, have constituted committees whereby the utility and its patrons—this inarticulate public that we hear about and yet do not fully understand—are brought into a closer relationship.

If my neighbor raises roses in his garden, and I am interested in the cultivation of roses in my garden, there is a common bond of sympathy between us on the rose question. And it seems to me that in these troublous days, it is wise—from the standpoint of the regulatory bodies of this great nation, from the standpoint of the utilities of the country, from the standpoint of the public dependent so largely for its comfort

upon the proper conduct of those utilities in their public functioning—that we find out whether or not there is not, somewhere around, a common rose garden in which we are all interested.

I believe, with respect to this public relationship, that there are one or two things that it would be well for us to consider, that go back of this matter of mere publicity, go deeper down into a realization of the fundamentals of this relationship, than is merely embodied in the printed page or the circular sent out.

You know in some way or other, since these hairs seem to have turned gray, and since the step grew a little more faltering than it was in time gone by, and since the college doors were closed, I have come to that point in life where I do not believe that the problems of life can or will ever be solved by the mere logician or the application of logic, or clear thinking along clear, logical lines. And if you were to analyze that expressions with me for a few moments, you would find that all the great relations of life—the family ties at home, the affection for our children, the love of our great country—those things that make men, in the final analysis of things, sacrifice everything of a material kind in order to safeguard their homes as their castles, in order to bring their children up into the kind of men and women that God intended them to be, in order that this great nation shall be the kind of a country that, in its God-appointed destiny, it must become—those are the things for which men make tremendous sacrifices of blood and money and those are not the things that you can measure on the scale of logic. They take us down deeper into the heart of man. And out of that kind of a thought that expression in individual life and that attempt to reach the human side which all of us possess, and which your patrons possess and which the public possess, if you can only put your finger on it, I believe you will build up the kind of public relationship I have in mind—the one which will make the fair balance between the utility company engaged in the rendition of proper public service and a contented body of patrons, which is one of the best assets that a utility company can have.

I confess myself to be a pronounced individualist. The individualistic philosophy has been more talked about in the last twenty-five years, and less realized, in this country, than possibly any other period in our national existence. Theoretically, it is enthroned, it is written into our Constitution and we have the idea concerning it, and the idea is splendid, for I confess myself to being of that school that speaks in terms of and tries to live with an appreciation that we must enthrone the individual. But in his enthroning I fear that we have got the wrong attitude of mind toward him, and I think that we have failed to appreciate our position in respect to that.

I just want to say one or two words along this line, to see if you will agree with me that it ties in with the deeper subject of establishing proper relationship.

Concerning that, we have been told by our political friends that each of us represented a sovereign, and yet I do not see many of us that ever realized what the politicians told us. The politicians of any party very often have told all the public that they were fundamentally statesmen, and they all ran for office as a result. And we have had lots of expressions of that kind, but that does not concur with my thought with respect to this individualism that must be cultivated in order to build either the type of a constituency for your companies or

the type of constituency that makes up a great nation filled and throbbing with the spirit of that kind of sacrifice and attitude that shall make the wheels of industry go around, it is true, but at the same time do all of those things that lead to the betterment of this great world of ours.

Now, will you stop with me, or pause with me just a moment, to analyze these things that hover around individualism?

We hear a great deal concerning the rights of the majority and "majority rules." There is no more mistaken philosophy than to put our faith and our hope upon this so-called majority. Why, there is no such thing, except long enough for us, perhaps, to step to the polls and drop our ballot in the ballot box and shout, if we are winners, etc. But the moment we have performed that particular office and elected a few men to represent us in this way, then we swing back and become immediately members of a minority, pure individualists, and we have got to get our rights that way. What I am seeking to bring to your attention is that in the final analysis all the great things of life that we prize and all the hopes that we have and all the protection that we receive in our land, or in any other land, if there be law and order therein, we have got to step up and, as an individualist, ask for them.

Do you send your children to the school under your rights as a part of the majority, or do you exercise your individual right? And are you not therefore, interested in preserving that individualistic thought that I am trying to present to you tonight with respect to your right to send your children to school?

Do you pay your taxes collectively or as individuals? And are you interested in the minority rights in the matter of your taxes? If somebody invades your rights, do you gather together the whole community and go into the courthouse and say, collectively, "I am going to enforce my rights against this invader of them"? Or do you march down the aisle of that court, as an individual, and ask to have your rights adjusted?

I want to get you back, if I may, to the thought that all the things that constitute human contact are those individualistic ones that relate to minority. Unfortunately, however, in these modern times, and because of the complexity of things, we have been getting away from that, and we have been entrusting these minority rights to others. We have not been watching out for them ourselves, and, consequently, when anything goes wrong, we say, "Go pass a new law." If the utility is wrong we will rush to the public service commission, and if the public service commission is wrong, we will wipe it out of existence—ignoring that back of it is this thought that I am trying to bring to your attention, that the individual contact must be cultivated and the individual brought up to a higher appreciation of his responsibility toward his neighbor and also his responsibility toward himself.

And again, just a moment with respect to this complexity which is a working out of what I have to say—that interrelationship is bound to result if a realization of this is properly appreciated and properly brought to the attention of the public. As in the olden times the old oaken bucket constituted the water system, now a complex system has to be arranged and the other man has to supply it for us. We are dependent upon this man and he is dependent upon us, and together we constitute the community and each of us must do his part.

That brings us down to my final thought with respect to this whole matter of public relations. Going back to an appeal to the fundamental fair sense, to an instruction of the public with respect to this factor, that these utilities, under the declaration of the states, have now become essential to their well being, and that the utilities are composed of men and men interested in them. And this line of contact is predicated upon the deeper thought that I have attempted, in the few moments that I have been addressing you, to bring to your attention, and, it seems to me, it is the bedrock of the fundamental principle in the matter of public relationship.

Hon. H. V. Osborne: The remarks of Mr. Ainey must have supplied you with a wondrous amount of food for thought. They were very potent in their suggestion. They indicate, if we follow them to their logical conclusion, the tremendously important place that the utilities have come to occupy and the tremendously important responsibility that you gentlemen have assumed in the life of the community today.

We have outlived the day when a certain famous gentleman made a certain famous remark about the public—at least most of us have. There are some relics left who still seem to retain that point of view, and I suppose that by this time it is so inbred in their constitution that it will never be eliminated until they are six feet underground. Because after a time, you know, it is very difficult to change our attitude. But the attitude of such gentlemen does not represent, by any means, the outstanding, the forward looking, the intelligent, patriotic attitude of the modern man who realizes his responsibility to civilization and his obligations to his fellowmen when he takes upon himself the burden of directing the destinies of these great corporations which are so vital to the life of the community.

That, I believe, is the modern conception of the modern utility, and the modern utility management, executive, employee, in the light of conditions today.

As has been suggested, it is the harmonizing of these relations that is so desirable and that is going to bring about an understanding that will mean the passing away of most of our difficulties.

When capital, on one hand, that supplies the money to make these operations possible—when the public, the great mass of the people who use these facilities, and the state, through its legislative body, acting as a matter of convenience, merely through its utility commissions—when these three great interests reach a common understanding as to their duties and their responsibilities and a keener appreciation of what this whole problem means, then I think we will have reached the most that we may expect in the perfection of public relations. And I believe the day is not far distant, through the propaganda which you men are carrying on and should carry on for the education of the public, through a keener understanding and perhaps a better appreciation of the efforts of the state regulatory bodies who stand in the position of being between the upper and the nether millstone, with the public on one hand and the utility on the other—I believe the day is not far away when you will come to realize that the sole thought and the desire of these regulatory bodies is to deal honestly, fairly and justly in all matters of dispute between the companies and the public. When that has been accomplished the investor will not only readily put his money in but he will seek for the opportunity of investing in

an enterprise which is so ably and intelligently managed as you gentlemen are so ably and intelligently managing this enterprise, and which is regulated with such honesty and fairness as we hope will be the case at least in the future. Then you will have no difficulty in raising the money to give the service and have on every hand a satisfied public, so that in the end, perhaps, these regulatory bodies will just naturally go out of existence because due to the perfection of your efforts there will be nothing further for them to regulate.

(Musical selections by the Madrigal Singers.)

Hon. H. V. Osborne: Now I would like to introduce the next speaker, the Honorable Henry G. Wells, of the Massachusetts Commission of the Department of Public Utilities, who will address you on "Public Relations from the Commission Point of View."

PUBLIC RELATIONS FROM THE COMMISSION POINT OF VIEW

Hon. Henry G. Wells, Massachusetts Commission of the Department of Public Utilities.

It is true today that a company which does not recognize the necessity of developing popular good feeling is almost unknown. It should be stated that hundreds of cases of complaints are taken care of by such companies that never reach the regulating bodies or commissions.

Quoting from an editorial in a trade publication, "Operating in a co-operative manner, great strides have been made in all phases of public relations and a universal recognition exists of the necessity for maintaining these conditions under all circumstances and at all times."

The mere fact that such discussions as public relations are on your program, the sentiments expressed at your conventions, are indicative of the fact that you have broadminded leaders who are earnestly seeking a constructive policy in order to maintain the highest type of public service and a sound standard of proper public relations. Practically all companies are earnestly striving toward that end. For that reason, it seems best tonight not to discuss glittering generalities about public relations with which you are all familiar and with which, for the most part, you all agree. Is it not better to attempt to point to certain failings, evident in the minds of a regulating body, in order to help you in the avowed purpose of eliminating those things which remain as a source of friction between the companies and their customers—even though those alleged faults may apply only to the minority of companies, perhaps only to isolated cases? At least, such seems to me to be the more practical method of treating this subject. With that in view, necessity compels me to speak from a standpoint

of personal observation and experience, and hence you will pardon me if I dwell at too much length on conditions in Massachusetts. Perhaps such conditions may apply elsewhere and may even be universal.

One thing I feel, however, may be set down as universal. It certainly is true from my own observation. The companies who do the most in an attempt to set up proper relationships with the consumers, whose executive heads are earnestly striving to create good feeling among the public it serves, have been more successful in combating the old demagogic spirit of hostility to public service corporations. That is made plain in the fact that the names of such companies appear less frequently in our files as being complained against than the names of other companies who are less active in cultivating such a spirit. Probably the various companies' records themselves would also bear out that statement.

Of course, public relations mean personal relations. A company may often be judged by some action of its lowliest employee. That is the difficult feature of your work, to train each and every employee who comes in contact with the public to be patient, courteous and tactful. The point of contact is threefold—by telephone, by letter or face to face. Just how much do you executives know of the method of handling calls by your telephone girl or girls? Connection with the wrong department, or no connection at all, or a cutting off after connection, misinformation, information grudgingly given, or no information at all—all these sometimes make the difference between friends or enemies of your company.

A customer writes to a company and receives, in reply, Form Letter No. 32. He writes again, indicating that the form was not elastic enough to fit his trouble. Form Letter No. 44 reaches him, and he gives up in disgust, but not with the utmost friendliness on his part.

As to the meeting face to face—your meter readers probably come in contact with practically all your customers or the customers' families, many of whom would not think of coming to the company's office. Probably these employees can do more than any other employees in keeping the customers good-natured. How much time do you give to the personnel of these employees, their conduct or their compensation?

Then there are the customers that come to the office. It is easy for a person entering the office of a public service company to go away with a feeling of hostility to the company if he is not handled properly. Too many employees seem to think that because they know where every department is located and know all the inner workings of the company that any one else entering the office is densely ignorant if he is not equipped with the same information. The result is often unreliable information and a brusqueness of attitude which repels the customer. He is shunted around the corner, upstairs and downstairs, and is lucky to complete his business in the course of an entire half day.

Company officials, with the best intentions in the world, have seen failure in securing public confidence because of the attitude of one or two subordinates of the company who failed to realize their responsibility in dealing with the public.

When complaints can be traced to a particular department continuously, or when it is obvious that certain indivi-

duals are undoing all the efforts of others, it is time for action of a radical nature.

Those who are employed to listen to complaints and adjust them, if possible, should be selected with unusual care. The experience of the Department of Public Utilities of Massachusetts, in dealing with the specific complaints which escape the gas companies and reach us for consideration, has led to the general conclusion that criticism, perhaps of a minor nature and relating rather to the management of the company, which is easily corrected, may be based largely on the fact that those who are dealing with the public's complaints are either underpaid or overworked, or both.

Before amplifying this criticism, let me illustrate its alternative features—either overwork or lack of ability—by some examples drawn from our own experience.

A genial old fellow came to the office to complain about gas bills which had increased to several times the ordinary amount. In the spring he had used about 1,000 feet a month. During the summer it dropped to 400 or 500 a month, and in the fall it increased to between 1,000 and 1,500. This he considered proper. In the winter the bills rose to 2,400, 3,500 and 5,700 cubic feet. He knew that bills in the summer should be less than bills in the spring or fall. He knew that those in the winter should be larger than those of the spring and fall, but he also claimed that his winter bills were larger than the amount of gas which he had used.

He admitted that he had a gas stove as well as gas lights, which might in ordinary circumstances have used the amount of gas with which he was charged.

This case is ordinary in every way. It was a very easy complaint for the company to handle, because the customer had a temperament which caused him to state his case and, on its courteous reception, even though his opinion was not taken, to go his way philospohically. The company, through its complaint department, made no investigation of the case, assumed that the bills were correct in view of the fact that the meter showed that the gas had been consumed, and, hence, spent no time upon it. There was nothing unusual except the personality of the customer which led to the conclusion that, in spite of the improbability, it might be possible that he had an adequate notion of the relative use of gas in his place at different times.

After he had stated his case to the department, we asked the company to make a thorough examination of the premises in a search for improbable causes. The customer occupied a single house, but shortly after the war had had a separate meter put in two attic rooms which were occupied by his son-in-law. A single riser had been run from the second floor piping to serve the third floor meter. It appeared that the thrifty son-in-law had run a drop from the rear of his apartment to a plug fitting in the back hall so as to enable him to operate a small stove from the paternal system, while his lighting registered on his own meter.

This case is a good illustration of the fact that some cases are not so simple or evident as appears upon their face, and that it is evident that something more than ordinary common sense is required in the detection and explanation of such cases to the public and an obli-

gation to devote a little time to a study of cases which appear on their face to be only ordinary cases.

Another case indicating that the cause of the trouble is sometimes not readily apparent: A woman brought a bill to us amounting to $1.14, which represented a two months' period. A gas stove and a drop light were connected to the pipes, but she was positive that no gas had been used except that burned by the company in clearing out the air when the meter was installed. Now, you will all admit that ordinarily such a statement would warrant the conclusion that some 700 feet of gas had been used of which the woman had either no knowledge or no recollection. You will admit, also, that a gas leak amounting to a half a foot an hour would not escape detection and would probably render the premises uninhabitable.

We showed the woman how to use the testing dial of the meter to detect the passage of small quantities of gas, and asked her to have the meter carefully observed for an hour. She did so, and sent us a sketch of the travel of the hand on the small circle, which showed in an hour the passage of practically one half foot. The house piping ran only along the cellar ceiling to two risers to the first floor, so that any leak which occurred must be either in the cellar, which the company visited in reading the meter, or in the living rom or kitchen of the first floor, which was frequented by the customer.

Looking for a leak amounting to one half a foot an hour under such circumstances seemed almost a waste of time, but the company undertook it. A split fitting was found in the cellar which blew directly against the side of an old and very porous brick chimney. As a matter of fact, the odor of gas was almost imperceptible. The company replaced the defective piping at its own expense and, although it took the customer a year or so to recover from the animosity which had been engendered by her dealings with the company before she came to us, she has subsequently come into the group of the company's friends.

Take another case: A physician called with a series of gas bills. The meter readings had been, successively, 954, 016, 000 and 158. The company had rendered bills for 6200, 8400 and 15,800 cubic feet. It was apparent that there was something extraordinary about the meter, which ran backwards from 016 to 000 and thence forward to 158, and further, that there was something remarkable about the mathematical ability of the clerk who could subtract 016 from 000 and deduce a consumption of 8400. The complainant called on the company to explain that as a result of the extraordinary coincidence he had been overcharged for 10,000 feet of gas.

It happened that the adjuster of this company is known to us to be a competent and painstaking individual who does not confine himself to the office but will pursue a complaint nights or Sunday, wherever it may lead. The physician met him in the office with a throng of other people. He stated his complaint. He was met with the explanation that he should consider that the 000 was prefixed by a "1," and that if that were done the subtraction would be feasible and the bill correctly figured —an explanation which the adjuster had probably made several times during the course of the morning and would make again before the room had been cleared.

To escape the amused grins of the

other complainants, the physician left the adjuster and came to the State House. We telephoned to the adjuster and he made the same explanation to us. It was only when we asked him to make the subtraction, figure by figure, that he realized that the explanation did not fit, and the necessary corrections were made.

Take another case from another company, likewise known to us for the competence of its adjuster. The previous reading on the bill was 54; the last reading was 121. The customer notified the company that there had been an overreading and that the bill for 6700 feet of gas was incorrect. The company had a re-reading of the meter made two months later and found the meter to register 76. This company also developed mathematical ability and subtracted 121 from 76, securing a bill for 5500 feet, which it sent out, not as a corrected bill, but as a bill for an additional amount.

When the exasperated customer called the company's attention to all the unusual features of the account, he received a letter stating that inasmuch as the final reading of 76 had been a verified reading the account must be considered as correct. As a result, bills for 12,200 feet of gas and the associated correspondence were sent to the State House. Here, again, the attention of the company was brought to the significant features of the account, after which it made its apologies and tendered a corrected bill for 2200 feet.

These two complaints coming from competent adjusters will illustrate what seems to us to be the result of overwork, in the sense of an indequate provision for the time which is necessary for proper consideration of the complaints. That is all you, who are responsible for the organization of a company's work, are in a position to answer—whether or not you have provided a sufficient personnel and a sufficiently qualified personnel for taking care of this important aspect of your public relations. Consider the prevalent salary in your communities for competent stenographers, the salary of someone who does shorthand, typewriting and, we will say, filing. How much more than the salary of a competent stenographer do you pay to those whom you hope are qualified to analyze complaints clearly, to correct such mistakes as have been made, and to adapt the effective explanation which is involved to the type of man which the complainant represents, and to do this in such a manner that the feeling of grievance will be removed and a satisfactory feeling toward the company established for the future?

All these cases lead to the conclusion that the companies' adjusters are underpaid and overworked.

One other thought in connection herewith occurs to me. It has seemed as though in many cases these adjusters were not only overworked and underpaid, but are given too little responsibility and bound down by hard and fast rules of the companies. There are too many cases involving only a few dollars, at the most, where complainants are rebuffed because the adjuster is a mere automaton, is compelled to refuse to deal with the customer because of some rule of the company. An enemy is made, whereas it was possible, without appreciable loss to the company, to compromise the matter and make a friend.

I have said that the situation is easily dealt with because the number of ad-

justers is small, the amount of money involved is small, and the problem of effectively organizing the work with most companies is simple.

Pick individuals for such positions as you would for accountants or engineers, who are competent, intelligent, tactful and possessed of good judgment, pay them well, give them responsibility, authority to adjust complaints without reference to higher officials—and your troubles will be minimized.

The last two cases referred to above bring out another idea associated with the consideration of public relations. It is not peculiar to gas companies, but it is perhaps peculiarly important for gas companies because of the tendency of gas customers, particularly, to complain about large bills.

A study of 1,000 gas, electric and water supply applications in Massachusetts, indicates that 347 related to gas companies. Of the 347, 270 related to meter readers' mistakes or large bills. Of the gas complaints during the last calendar year, out of 222 complaints, 132 involved the question of large bills or meter readers' mistakes.

The large bill complaint is an easy type of complaint to deal with in its technical aspects, but it is most difficult to deal with on account of the personal difficulties involved. It is simple, technically, because the certified meter is the customer's protection and the source of nearly all the information that he needs.

For a generation, the companies have been exhorting customers to read their meters. Companies and associations have joined in publishing the facility with which meters can be read. Our department has issued a circular on the gas meter and gas bills, indicating how a meter should be read and tested, and yet we continually encounter conversation like this:

"My bill is too big."

"What makes you think so?"

"The size of it. If you think I cannot read, look at it yourself."

They will look at the bill. They will talk about the bill. They will prepare comparative statistics based on bills. Perhaps they will have the meter tested, but under no account does it occur to them to read the meter.

When we ask for the state of their meters, why do business men, nurses, firemen, policemen, all come back to us with a sketch of the dial? They read books, thermometers, speedometers, and they can tell time. Why do they make their mark when a meter reading is involved?

Is it not somewhat of an anomaly in these days, when companies are doing so much to create satisfied customers, to have installed on their premises a meter with various whirligig dials, some of which turn one way and some another, some of which the customer uses and some of which he does not, and a dial which is labeled "cubic feet" but registers nothing smaller than 100 and registers that on a circle which may bear either of the cryptic legends, "hundreds" or "1,000"?

I have said your customers read books, speedometers, watches and clocks. To put the case of the ordinary meter dial before you, let me ask you to consider the probable fate of a watch company which produced an affair on which the hands ran in opposite directions, a book publisher who printed alternate lines in opposite directions, or a speedometer manufacturer who produced a dial like that of a gas meter.

The gas meter is intended as the customer's adviser and protector. In reality, it is only an oracle on the cellar shelf which the company goes through the form of consulting monthly before it sends out its demands.

Is it not worth while to have a meter dial that can be read without a college education?

This may seem like treading on dangerous ground. Let me say that I do not even know whether there is any such meter in existence or not, and I have no interest in any particular form or type of meter. It does seem, however, that companies which pride themselves on keeping up-to-date, companies that boast of the great progress that has been made in the development of the business, ought to be able to spend a little time in developing a meter which is read easily.

Perhaps it is a question of expense. Nevertheless, it does seem as though a proper meter could be found and that it would not take a great deal of time or a great deal of expense to gradually replace the old meters. The probability is that in changing the dial it would not be necessary to go to great expense or trouble in changing the entire meter, but that some form of dial could be found which could be easily adjusted to the existing meters.

This matter, together with the matter of the pay and the work of the adjusters, seem to me to be the most important things to bring to your attention at this time, particularly in view of our experience.

The regulatory bodies throughout the country, I feel safe in saying, which have jurisdiction over such companies as yours, feel that your companies are cooperating with us to render the type of service desired. You may feel that we are unnecessary, but many times it has been a blessing to a company to find a sort of buffer between the public and the company in the form of a regulatory body. The public, rightly or wrongly, will many times take the word of a disinterested party like a commissioner and feel satisfied, where it would be almost impossible for a company man to convince the public that they are wrong.

However, such a commission is in existence to regulate and not to manage. It is evident that a company management which allows a state department to take the place of an adequate organization of its own is encouraging the public to seek elsewhere than in the company's management a solution of its service problems.

We believe the ideal situation to be that one wherein the relationship between the public and the company is such that there is mutual trust and mutual co-operation, so that our bodies will be appealed to rarely, if ever, to straighten out service difficulties.

I congratulate this organization on its attitude in such matters. I believe that you are working along right lines. I believe that as time goes on you will approach very nearly to that ideal.

(Musical selections by the Madrigal Singers.)

Hon. H. V. Osborne: Probably the most interesting, or one of the most interesting aspects of the general discussion tonight is now to come on the subject of, "Public Ownership," by F. G. R. Gordon, of Haverhill, Mass.

PUBLIC OWNERSHIP

F. G. R. Gordon, Haverhill, Mass.

A great many millions of American people are running loose up and down the highways and byways and the broad walks of this country, who earnestly and honestly believe that the City, the State or the Nation can operate industry better than such men as you, and the reason for that is that there is a calamity howler born every minute, and he lives for fifty years, and along with the birth of the calamity howler there is also born a sucker, and both of them live far beyond their allotted time.

Ever since we began as human beings in this nation we have been cursed with the medicine men. We had them under barbarism and we have got them under civilization, and we are going to have them to the end of time. And perhaps the most dangerous of all these medicine men who have ever afflicted the human race are these men whom we call "parlor Socialists," and the other and still larger and more numerous citizenship whom we call "half-baked Socialists."

What do they want? In the first place, they want your property. Perhaps you may not have kept track of the radical press of this nation. Perhaps you have not been reading about the Farmer-Labor group, which has in its platform a demand for the socialization of not only the gas industry but $75,000,000,000 of private property.

A couple of years ago I talked with a member of the Executive Board of the Farmers' Union in the State of Oklahoma, and I said to him, "What do you men want?" He said, "In the first place, you will agree that when the farmers in the country and the workers in the city unite together, we will be able to run this government. Up to the present time Wall Street has been running the government, and we are sick of it, and we are going to take possession of this government ourselves."

I admitted that would be true if they ever made that kind of a combination, but I said, "What do you want?" He said, "We want the U. S. government to own all the mines, the railroads, the telegraphs, telephones, and we want the state to own the stockyards, and the cold storage plants. We want the citizens and the towns to own all of these public utilities, water power, and everything of that sort."

I said to him, "Let me come up and talk to your men this afternoon." He said, "No, we wouldn't allow anybody like you in our hall."

That is the way they feel about it, and that is the organization, that is the movement, that elected the Governor of the State of Oklahoma by 50,000 majority.

You have just had an election in the State of Minnesota, and there you have between 350,000 and 400,000 radical voters who want to take your property over into the hands of the government.

It is a strange thing that they have that idea. They remind me of a couple of chaps by the name of Isaac and Jacob who went into business. They went into the fruit business. They did not trust each other so they both stayed around the fruit stand all day long and ate up all the fruit, and failed in business. Then they separated and each went his way.

Six years later they met. After congratulating each other upon his prosperous looking appearance, Isaac said to Jacob, "What have you been doing all these six years?" Jacob said, "I have been making and selling patent medicine." Isaac said, "I have been doing the very same thing. Listen to this testimonial I have from a young lady." He pulled the testimonial out and it read like this: "I was born with my left leg three inches shorter than my right leg, and upon my right hand I didn't have any fingers at all. Since taking nine bottles of your Cure-All Medicine, my left leg has grown to its proper size and I have a full set of fingers upon my right hand."

Jacob said, "That is pretty good, but listen to this testimonial I have." He pulled out of his pocket a testimonial from a young lady, which read like this: "I was born without liver or lights. Since taking six bottles of your Electric Bitters, I have a new liver and electric lights."

That is the kind of a cure-all they have.

Now, this Farmers' Union that I spoke about is organized in thirty-five states. It has one million members. There are six millions of organized labor membership in this country, counting all of the various varieties, and they have taken official action everywhere, all over this country, in favor of the socialization of your property, all utility property.

They have voted many times to do this thing. I have had fights on municipal ownership from Maine to California, and I have yet to have a fight where organized labor did not array itself solidly in favor of municipal ownership.

How do they carry on this fight? That is an interesting thing. Let me quote an editorial published in a number of newspapers which boast of the largest circulation in America. In the year 1915, before we had entered into the war, the New York "American" published an editorial upon the German Empire and its railway system, which read like this:

"Before the war, the German Empire, one of the most expansive nations upon the face of the globe, derived one half of all the cost of carrying on that great government through the ownership, the operation and the profits which it derived from the operation of its railways, its telegraphs and its telephones. If the German people can make two hundred and fifty million dollars a year profit upon the ownership and operation of 33,000 miles of railroad, what could the United States do if they owned and operated 260,000 miles of railroad? We ought to do it anyhow, and if we did this thing we would secure cheaper rates, cheaper freight rates, and pay larger wages to the men who operate the railroads. So by right we should do this thing anyhow."

Now, you will agree that that is a very plausible editorial, and the only trouble with that editorial was that there was not a single word of truth in it, although it was published in a thous-

and newspapers in America, which reached a total circulation of more than 20,000,000.

If that socialistic editor had wanted to tell the truth about the German railroads as they existed in the year 1914, he would have said this—that the German Empire did not own one single mile of railroad—that although those railroads were socialized, they were owned by their respective states in the same manner that New Jersey might own the Jersey Central Railroad, or the states of New Jersey and Pennsylvania might own the Pennsylvania Railroad System—just as the two states of Prussia and Essen owned the great Prussian-Essen Railroad.

If that socialistic editor had wanted to tell the turth about those railroads he would have said this—that in the year 1914 it cost the German people 1-47/100 cents to get a ton of freight transported one mile, whereas we do the same job in this country at a cost of 71/100 of a cent per mile.

The German railway employee received an average wage of $408.00 per year, as against $810.00 per year paid to the railway employees of this country. And whereas the German people paid a freight bill that year of $502,000,000.00, if those same German people had enjoyed the cheap freight rates which prevail here in America, they would have saved for themselves that year $250,000,000.00.

On the other hand, if the American people had been forced to pay that German rate for the transportation of freight in this country, your freight bill for the year 1914 would have cost you $4,000.000.00 a day more than it did cost you.

That is the truth about the German railroads.

Or, to put it in another way—while we were transporting 90% cheaper than those German socialized railroads, we were paying double the wages to the men who operated those railroads.

And as for the telegraph and telephone, not one of them was ever able to make both ends meet. They have all been socialized over there across the water, and, if you lived in Paris, Vienna or Budapest in the year 1914, or before the war broke out, and you wanted a residential telephone in your house, you would have paid an average price of $77.70 per year, which is vastly more than you have to pay in the city of New York. And if you had lived in a little city the size of Atlantic City, you would have paid an average price of $70.00 per year for your residential telephone and would not have had any service on Sundays, holidays or after ten o'clock at night.

The German telephone system was losing three and a half million dollars a year, that of France was losing a million, eight hundred thousand dollars a year, and the girls who operated those socialized telephone systems of Europe received a wage that ranged all the way from $2.68 per week to $5.20 per week. How would you like to change places? How would you like to trade the system developed here under private ownership for that stagnated system over there?

Since 1870, the British telegraph has been owned and operated by the British Government, and it has become so demoralized and so slow that if you wanted to telegraph from London to some citizen in Liverpool, you would debate with yourself as to whether or not you had better walk between those

two cities and deliver that message yourself.

The railways of Europe, which have been socialized for many, many years, are characterized everywhere by low wages, high freight rates, large annual losses and rotten service.

Switzerland, one of the oldest republics in the world, has within the past ten years, socialized and operated its railway system, and today it costs everybody five and one half cents per ton to transport a ton of freight one mile in that country, as against a trifle over one cent per mile per ton in this country, and the wages here are a little more than twice as high as they are in Switzerland.

Now, I think perhaps Canada gives the best illustration of this theory of public ownership, because in Canada there were, up to the year 1914, three great railway systems that have been in operation for thirty-five years, two of them under private ownership, and one of them under public ownership. The Grand Trunk and the Canadian Pacific had, up to that time, paid dividends to their owners, given splendid service to the people of Canada and paid millions of dollars in taxes to help support that Government.

On the other hand, the Inter-Colonial Railroad, constituting a system of 1741 miles of railroad, was built, owned and operated by the Dominion. Into that white elephant the people of Canada had sunk, in appropriations, three hundred and eighty-five millions of dollars. If you extracted the entire value of that railway system from the sum the people of Canada had put in, you would learn that they had lost directly two hundred and sixty-eight millions of dollars, and, in addition to that, they lost thirty million dollars more because if you and I owned the Inter-Colonial Railroad, we would have had to pay taxes upon all that system.

The late James J. Hill, the great empire builder of the Northwest, said, "If I, and the men under me, owned the Inter-Colonial Railroad, we would make it the best piece of property on the North American Continent." Why? Because it stretches a thousand miles from the city of Montreal to the seaports at Halifax, St. John and Sydney. It runs through an extremely rich territory, it has a monopoly on the transportation of the coal mining from Nova Scotia and a like monopoly on the transportation of the products of the iron and steel mills of Sydney. Sydney is the Pittsburgh of Canada.

But that railroad has become known, from end to end of Canada, as "Canada's white elephant."

I went down over that road one time all the way to Sydney, and a farmer boarded the train at a little town, and I scraped up an acquaintance with him. He was a nice old chap. I said to him, "What's the matter with this railroad? Why do you call it 'Canada's white elephant?' Why doesn't this railroad pay?" With a twinkle in his eye, he said, "Did you see the conductor come through here?" I said, "Yes. Fine, accommodating chap. Nice looking man." "Sure he is a nice looking chap," he said, "and he is a politician. The man up in the engine is a politician, too. The man out on the track is a politician. You want to know what is the matter with this railroad? The men that operate the Inter-Colonial Railroad think more of getting the votes on election day than they do of getting the train in on time. That is the trouble with this railroad."

And that is the trouble with anything the government operates. As a matter of fact, go around the world and you will learn that the government requires two men and two days to accomplish that which private ownership will perform with one man in one day. That is an everlasting truth, to be proved everywhere.

Also up there in Canada is another illustration. For a few years the Province of Manitoba socialized the Bell Telephone System, and there was a little incident connected with that which illustrates this theory. The little town of Woodridge owned a home telephone, but it did not reach beyond the boundaries of that town. After the Bell System had been socialized and had lost about a half a million dollars, of which they were paying their part in losses, they resolved that they ought to have a line built to connect with the outside world, so after much agitation a meeting was held, and at this meeting resolutions were passed, saying that if connections were not made the political party in power would not get any votes on election day.

When you talk to a political party about votes, you touch a vital spot. So the political leaders conferred for a little while and finally, ten days before election, a freight train rolled into that town and two cars were set off on the siding, loaded with telegraph poles, and along came a gang of workmen and unloaded those telegraph poles from that side track.

In about fifteen minutes everybody in town knew what had happened and everybody congratulated everybody else upon the fact that they were going to be able to talk with the outside world. So on election day they rolled up a smashing majority for the political party in power.

Ten days after election, that same freight train rolled into town again with two empty cars, put them on that same side track and the same gang of men loaded those telegraph poles on those cars and carted them out of town.

Now, I think you will agree with me that that is the first time you ever heard of a great political party fishing for votes with telegraph poles.

If you went out of this hall tonight and met some socialist out there on the boardwalk and said to him, "That chap Gordon there is kind of ripping public ownership up and down the back. What do you think about it?"—do you know what his answer would be? He would say, "This is the trouble. The old political parties were in control in Switzerland, in Canada, in Germany, and all those other places, before the war. That is the trouble. If a labor party had been in power, if we had been in power, we would have run those railroads and telegraphs and mines, and so on, with great success."

And it is just because you have that kind of an answer, just because of that, you and I are going to take a little trip right now of five thousand miles. It will not take us but five minutes. We are going to a country which has made the most extensive plunge into state and municipal ownership of any other nation upon the face of the globe. We are going to faraway Australia, and in that country we will find that the railroads have always been owned and operated by their respective states: likewise, the telegraph and the telephone. Over there, they not only own those public utilities, but they own the coal mines, the tin mines, they own ships that go

out upon the sea and catch fish, they own wholesale and retail fish markets, they own slaughtering establishments, and they own wholesale and retail meat markets; they own hotels, they own farms, they own implement factories, and in the city of Melbourne they own a great factory devoted to the production of freight and passenger cars and locomotives for the socialized railway systems of that country.

One of the states owns thousands of acres of land upon which it raises cane —I mean sugar cane—and they own the factories that convert that sugar cane into sugar.

And because they have made that extensive plunge into State Socialism, they have become the champion debt-ridden states of all the world.

You might say I was unfair if I told you that the debt of New Zealand at the present time amounts to more than five thousand dollars for every single family living there, but if you go to your Public Library and take from its shelves the statistical abstract issued by your government annually, for the year 1915, before there were any war expenses, you will get from that book the facts which I am now about to cite to you.

On the first day of January, 1914, the debt of the Commonwealth of Australia and those states there, amounted to one billion, nine hundred and thirty-six millions of dollars.

Upon that very same date the combined debts of the forty-eight states of America and our national government, amounted to one billion, three hundred and thirteen millions of dollars.

Their debt over there was six hundred million dollars greater than our debt here, and we have twenty times their population.

How would you like to change places?

Let me put that in another way so that you can go out and tell your socialistic friends about it. If, on the first day of January, 1914, every single family in America contributed the sum of $65.00, that $65.00 would have been sufficient to have wiped out all the debts of our forty-eight states and the federal government.

On exactly the same date, and by exactly the same process, if every family in Australia had to pay their proportionate share of their debt, every family would have had to go into their pockets to the tune of $1555.00 to have paid their state and national debt.

$65.00 here against $1555.00 over there! How would you like to change your system of private ownership to that of public ownership which they have in that great democracy of Australia?

And then, again, over there, where they pay only half the wages we pay for the men who work on the transportation system, or the men and women who work in the telegraph or telephone system, or upon the street railways or in the gas and electric plants—the cost of public service over there runs all the way from three to six times as much as it does in this country. It costs the farmer actually six times as much to get a bushel of wheat transported a mile over there as it costs us here in America. Why, it costs a man as much in Australia to get a bushel of wheat transported a distance of two hundred miles as it costs us to take a bushel of wheat in the city of Chicago and land it in

the city of Liverpool, a thousand miles by land, three thousand miles by water.

And in that great government factory at Melbourne, where they manufacture locomotives, sometimes they are unable to produce a sufficient number of locomotives, so they come up here to Philadelphia to the Baldwin Locomotive Works and buy one of those great pacific type locomotives, load it on board and ship from Philadelphia harbor. In the year 1914 they did that and sent it way down around Cape Horn, landed it in the city of Melbourne and saved eight thousand one hundred and sixty-eight dollars by the operation.

How did they do it? They did it in this way. Under that blight of public ownership they have a new form of labor in Australia and that new form of labor is called "Government stroke." You can already guess what "Government stroke" means. "Government stroke" means that they do as few strokes as possible in a day, or an hour, or a year. Consequently, in that government machine shop, which is the finest system of a closed shop operated in all the world, it requires three men to do one man's job.

Now, we are not much better in this country, friends. I have had some experience in that, and I am going to take two minutes to tell you about it.

In the year 1907, when the late Colonel Roosevelt was president of this country, they passed a law relating to immigration, known as the "1907 Act." I happened to be the first man in this country appointed to office under that new law.

After two years in Washington, they divided up the country into sections and gave me the New England states to look after. I did not have much to do. I was working as hard as possible in order to find three days' work to do in the week, although I was drawing seven days' pay, and I was praying good and hard that the job might last the rest of my lifetime.

After I had held down that New England job for about three months, I read in the paper one morning that Mr. George Sheehan, a fine, capable young man of the city of Boston, had been appointed as an Immigrant Inspector to help me do my job. After George had trained around with me for three weeks, he was then able to perform the work alone, and then George and I were in a situation where we were doing less than two days' work in a week and drawing fourteen days' salary—and I am telling you my praying qualities suddenly increased enormously.

That is the way the government everywhere does business. You could no more expect this government, or any other government on the face of the globe, to run a gas plant, an electric light plant, a coal mine, a steam railroad, or any other kind of an industry, successfully and economically, than you could expect a bowlegged girl to get married in the town where she was born.

Men of the gas industry—if after the next presidential election you woke up and found, the morning after election, that the Farmer-Labor Party in this country had polled eleven million votes and sent one hundred members to Congress, you would not be concerned with any questions about the distribution of gas or how to produce it cheaper, you would not be indulging in expositions or anything of that sort—you would be burning the midnight oil in order to

learn ways and means of combatting such a movement as that.

Yet in that great democracy of Great Britain, in the last Parliamentary election, the Labor Party, which has in its platform nothing hardly except public ownership, with the exception of one plank which demands the confiscation of property — that political organization polled four and a half million votes and elected a hundred and forty-two members of Parliament. They only have 44,000,000 of population over there as against 110,000,000 here, so that if we had a labor movement over here relatively as strong as that British Labor Party is over there, you would find a hundred members in our House of Representatives, many Senators in the Senate, and a total vote of 11,000,000. So that would cause you to sit up and do some pretty tall thinking.

My time is already exhausted. This is a serious thing, gentlemen. When you have got six states in the Northwest that have a million and a half of radical votes—when you have got six states in the Northwest that you do not know whether the Democratic party or the Republican party, or both combined, will stand a chance of carrying in the next election or not—you have a pretty serious thing on hand, you have a pretty serious thing to face.

And so I say to you that this political movement known as the Farmer-Labor movement in some states and the purely Labor movement in others—I say that movement is not diminishing, but it is growing, and it is growing because men like you have not taken the opportunity to organize and meet that gigantic force which is spreading from end to end of this country.

And so my last appeal to you is this —that this is your country, you have no other country to go to. There are no more new continents that can be discovered anywhere. More than four hundred years ago the great Columbus, sailing across the wide and mysterious seas in search of a passageway to India, discovered America. We cannot make much further progress to the north, because of the cold and inhospitable climate; neither can we go to the south.

So here upon this continent, made sacred by the blood and the sacrifices of the fathers who handed down to you and to me the finest system of government the sun ever shone upon, there was also handed to you and to me this supreme duty of seeing to it that this great republic does not perish from the face of the earth.

MINUTES OF THE ACCOUNTING SECTION

FIRST SESSION

Tuesday Afternoon, October 16, 1923.

The first session of the Accounting Section was called to order by the chairman, Mr. J. W. Heins, the attendance being approximately 400 members and guests.

(During the reading of the chairman's address, Mr. W. A. Sauer, *Vice-chairman,* assumed the chair.)

ADDRESS OF THE CHAIRMAN

J. W. Heins, Philadelphia, Pa.

Another milestone has been reached in the affairs of the American Gas Association and the Fifth Annual Convention brings together delegates from far and wide. To each delegate the Accounting Section offers a warm welcome to attend all of its sessions where will be presented reports and discussions of its several active committees. These reports are of such a constructive nature that it is both hoped and believed they will prove to be of inestimable value to the members.

From the remarkable growth this section has enjoyed in its five years of service (an increase of approximately five to six hundred per cent), it is very evident that the section is functioning in a manner desired whereby the greatest good for the greatest number is being obtained.

It has brought, and is bringing into greater prominence the accountant and the commercial office man and offers great opportunities for developing economies in operations in their respective fields, all of which has served to form the basic principle upon which the section has functioned.

It has taken care of higher accounting through such committees as the Uniform Classification of Accounts, Fixed Capital Records and Budgetary Control. The commercial office practice has been thoroughly studied and analyzed as exemplified by the Committee on Relations with Customers and Customers' Accounting.

The members have shown an ever-growing interest in the affairs of the section and it has been our good fortune to have some of the ablest men in this branch of the industry serve on the several committees. These men through their many years of experience are eminently qualified to submit reports that are not only pertinent, but vital to the present-day conditions confronting the gas industry as a whole.

As a further means of bringing the several practices throughout the country into view of all concerned, the section has undertaken a very elaborate exhibit comprising all forms of present-day usage in both large and small companies. No one attending this convention should go away without making a thorough study of the exhibit. The report of the Exhibition Committee Chairman will undoubtedly bring out the salient features and it is earnestly hoped that the attendance by delegates at the booths of the exhibition will be in sufficient numbers to warrant the belief that the expense and trouble incurred has been amply justified.

The report of the Committee on Uniform Classification of Accounts and Form of Annual Report to Commissions will bring out very clearly the activity in which this important committee has been engaged and the results attained.

This committee has done admirable work; they have appeared before many regulatory bodies and through their able presentation of the subject and forcefulness have been able to bring about the adoption in many states of the Uniform Classification of Accounts which undoubtedly has meant a considerable saving to a great many companies.

The report of the Insurance Committee will show where considerable time has been devoted to the question of rates for workmen's compensation and public liability in the industry. This report will show that the loss ratio is so low as to warrant obtaining a considerable reduction in these rates and consequent saving to the member companies carrying this class of insurance. While the work has not been entirely completed this year, great progress has been made toward the desired end.

The Fixed Capital Records Committee has been active for at least two years past and has made considerable progress, but this year a considerably broader scope has been attained in that the work has not been confined alone to the accountants, but extended to the technical men as well. The able assistance of some of the foremost engineers engaged in this class of work has not only been sought, but very generously given in the compilation of their general report. It is believed the report of the 1923 committee will be one of the most constructive pieces of work of this character yet submitted and will be of like interest to the accountant and technical man in this very important branch of the industry.

The section has for some time felt the need for a comprehensive study of the many details incident to budgetary control for large as well as small companies, with the result that a committee comprised of some of the industry's ablest accountants was appointed to prepare a report for this convention which would deal in such a way with this subject that it could be readily understood by those engaged in this class of work in any of our member companies. The detailed report which they will offer is both complete and comprehensive and will be of direct interest to the executives of all companies.

The Customers' Accounting Committee through the extended application of the Baltimore system of "Bookkeeping Without Books" is another means of effecting economies in operation. The section has stood behind this plan of reduced cost in customers' accounting and the chairman in his report will show that where it has been installed, reports all indicate that the savings claimed have been, or are about to be, accomplished.

The outstanding report of this year's activities would perhaps be that of the Committee on Relations with Customers, it being the policy each year to have one subject which in itself furnishes an outstanding up-to-the-minute discussion for the good of the industry. The section is assured of not only a complete treatise, but one embodying a wide range of thought moulded into a composite report, in that not only have the members of the Accounting Section been fully engaged in its preparation, but in like manner to that of the Fixed Capital Records Committee, have drawn on the technical men engaged in this particular class of work. As a furtherance of this timely work, the section has been most fortunate in being able to secure for its speaker in the general sessions on Thursday morning Mr. P. H. Gadsden, who needs no introduction to any delegate at this convention. Mr. Gadsden's subject will be "Public Relations—Their Improvement Through the Gas Com-

pany Personnel," and because of his very wide experience along these general lines in all phases of public utility work, he is eminently qualified to present this all-important subject in a thoughtful, forceful and interesting way, and consequently no member of the Accounting Section should fail to be present to hear his address.

Attention of executives is again directed to the excellent opportunities offered by this section for the education and broadening of junior executives, junior accountants, chief clerks and commercial office men, particularly those who have come into the industry in recent years.

It is strongly recommended and urged that these men be encouraged to take greater interest in all these activities, particularly committee work. The juniors of today are the executives of tomorrow and a good return will be the reward for time and energy spent in this respect.

Now, by right of precedent it becomes necessary for the chairman to sing his swan song which is done with some degree of reluctance. To have served this section as chairman has been an honor, indeed. It has been an education and a pleasure, made so by the untiring efforts, zeal and ability of the supporting members with whom I had the rare good fortune to be surrounded. The friendships formed have been many, which thought in itself leaves a keen and sincere feeling of pleasure in having been permitted to serve you as chairman and softens the reluctance of retiring.

Your chairman takes this opportunity to personally and publicly thank each chairman of the several committees and each committee member for their whole-hearted and generous support given during the association year and particularly to Mr. W. A. Sauer, Vice-Chairman, for his able and ever-ready support; also to Mr. H. W. Hartman for his painstaking efforts and ability displayed as secretary of this section.

REPORT OF NOMINATING COMMITTEE

The secretary presented the following report of the nominating committee.

For Chairman—W. A. Sauer, Peoples Gas Light & Coke Co., Chicago, Ill.

For Vice-chairman—H. C. Davidson, Consolidated Gas Co. of New York, New York, N. Y.

(Upon motion duly seconded and carried, the report of the Nominating Committee was accepted and the secretary as instructed cast one unanimous ballot for the election of the officers as nominated.)

On invitation of the chairman Mr. Sauer responded as follows:

W. A. Sauer (Chicago, Ill.): I am deeply thankful for the honors that you have given me.

In accepting this office, I cannot help but feel that I have got to accomplish quite a bit in the next year when I look back on the records of the previous chairmen. Since this section was first started, each succeeding year has shown increased activity and larger programs

and greater accomplishment, and I feel, in order to keep pace with my predecessors, that I have got to add to that accomplishment.

But while realizing my task, I have this offsetting thought, that in any activity I have ever taken up, I have never found more willing workers than I have in this section. Our committee meetings both in the east and west were always well attended last year. That means that those from the west, myself included, are not only willing to travel east but those in the east are also willing to travel west and that spirit speaks for an increased attendance in our activities for the future and greater accomplishments.

Gentlemen, I only ask in the year to come that you give me the same cooperation that you have given Mr. Heins and his predecessors.

The Chairman: The next order of business is the report of the Exhibition Committee.

REPORT OF EXHIBITION COMMITTEE

P. D. Warren, *Chairman*, Chicago, Ill.

Our chairman requested me — as Chairman of the Exhibition Committee of the Accounting Section—to prepare a short report describing the work of this committee. At the time he made this request he strongly emphasized the word *"short"*; in fact, he told me that if it took more than five minutes to read the report it would seriously interfere with the rest of the program. I believe this report is going to please both the chairman and the audience, as I am not going to take more than half of the five minutes allotted to me.

The members of the Exhibition Committee are as follows:

P. D. Warren, Chicago, Chairman.
W. H. Cassell, Baltimore.
A. R. Kellar, Syracuse.
L. E. Sanderson, Rochester.
H. W. Hartman, Secretary, Assn. Headquarters.

The chairman has found his work both pleasant and comparatively easy, owing to the fact that all members of the committee have been equally active, and no one member was required to shoulder the entire responsibility.

The exhibit this year is considerably larger and covers a greater scope than the one last year. The Association has provided us with four large booths, allowing ample space to make our exhibit complete. The committee has attempted to make its exhibit as diversified as possible. You will find a working demonstration of the merchandising system used by the Rochester Gas and Electric Corporation of Rochester, New York, and also an exhibit of the *Todd Biller* which is used by this company, in a novel manner, for entering the gross and net amounts on their gas bills; there is an extensive exhibit of *"Bookkeeping Without Books,"* made by the Consolidated Gas Electric Light and Power Company of Baltimore; and a working exhibit of the new *Gas Billing System* adopted a few months ago by The Peoples Gas Light & Coke Company of Chicago; also a large and comprehensive exhibit of forms used in fourteen gas companies supplied by the Committee on Relations with Customers. One of our booths is fitted up to afford the members of the Accounting Section a convenient place to rest and meet their friends. In this booth will be found a complete set of the forms used by the Portland, Oregon, Company in their bookkeeping system which was so ably described by Mr. William H. Barton of that company in the last A. G. A. Monthly.

These different exhibits are offered to the visiting accountants with the thought that if any one of them presents some new idea, the time spent in the booths will be well spent. The committee does not present these exhibits with the idea that any one of them is superior to accounting methods used by other

companies. But, each one of these does present a new system that we believe the members of our section will want to know about even if they may not find it practicable to adopt the systems shown.

To those present who have not already inspected our exhibit, the committee extends a hearty invitation to visit it. We have arranged for each visitor to register at the booths and the chairman of the section for 1924 will appreciate any suggestions that you may make for subjects to be taken up during the ensuing year. Your committee will feel amply repaid for its work if, after viewing our exhibits, you leave with a feeling that we have given you any ideas that will be helpful to you.

The Chairman: The next order of business is the report of the Committee on Relations with Customers.

REPORT OF THE COMMITTEE ON RELATIONS WITH CUSTOMERS

A. L. Tossell, *Chairman,* Chicago, Ill.

Introduction

The first requisite for membership in the American Gas Association is that the applicant must be associated with the gas industry, or a kindred industry. Therefore, when our association speaks for our great industry on a subject so fundamental as Relations with Customers, we must assume that, to our industry and the American Gas Association, two things are of vital importance:

1. To establish principles in fair dealing that none of our company members can refute.

2. An appreciation on the part of our company members that the good name of our industry as a whole is dependent on their individual and intelligent application of the principles so established.

Even more is required than acceptance and application by our members of reports submitted, and that is, not only an adherence to progressive policies that from time to time are presented, but an interest in initiating new thoughts and standards. When a proposal of policy or practice is made to the association through, or by its committees, they should be considered, not as single opinions, but as the results of composite thought presented after intensive and extensive investigation, and painstaking deliberation.

The report presented herewith offers for your consideration the result of investigations, observations, conclusions, and recommendations by the Committee on Relations with Customers. Your Committee was divided into the four sections named below, each having its own chairman, in order to facilitate the work of preparation. The completed report is given in the following sequence:

1. Education and Development of Personnel.
2. Credit and Collection Policies and Contractual Relations with Customers.
3. Co-ordination of Order Taking and Order Executing Departments.
4. High Bill Complaints.

Barter and trade, or relations with customers, began before civilization, and yet

the subject is ever new. The development of gas for domestic and industrial uses brings thousands of new customers each year. As a natural consequence, new problems of relations with both old and new customers must be met and solved.

Although gas companies are essentially local monopolies, they must bid high for friendly relations with customers, for friendly relations are linked with progress. Instead of making our commodity available for only those who *must* buy, it is necessary that we offer a quality of service that will make people *want* to buy. Furthermore, we should maintain a continuous, informative campaign of education, to enable the public to have a better understanding of our service.

A UTILITY CAN ONLY JUSTIFY ITS EXISTENCE AND MONOPOLY BY A SPIRIT OF FAIRNESS, AND A DESIRE TO SERVE.

The lack of UNDERSTANDING on the part of our customers, is one of the greatest handicaps a public utility company has to overcome in the best development of its service.

A superhuman element does not enter into the management of a public utility; there is nothing strange or mysterious about it. The ordinary citizen understands something about our business. He has well developed ideas on how certain things should be done, how customers should be approached, and routine matters handled. These ideas are usually in keeping with the ideas and policy of the company. In fact, they are often the very thoughts of the management, and express policies which the company has been striving religiously for years to carry out.

Thus the management and its customers are as one, with the same desires, the same ideas of service, making it an easy task to find a common ground on which to stand and serve each other. Yet, there is a wide gulf between the utility management and its customers because of a lack of UNDERSTANDING. They have the same language, but as each has never heard the other's voice there is lack of understanding between them. They have the same thoughts and desires, but have never expressed them, each expecting the other to know what was in each mind.

Two forces, the same in purpose, are running parallel. It is the big job of the utility management to connect these two channels of thought, to make the contact and develop the power.

There is little satisfaction in a policy of courteous service to customers if they continue to only see distorted reflections. It is not enough for the utilities to be moved by a spirit of fairness. They must put it across to their customers and getting it to the public is the important job.

Every employee should feel and realize his importance and should be representative of all that the company stands for, so far as its customers are concerned. Mistakes will happen in all departments, and the effect of such errors on our customers must be eradicated, and their good-will maintained. This is the important work of any utility, and by its success the company's prosperity and standing is measured.

Two principal methods are employed in taking care of customers' complaints; viz., by correspondence, and by personal contact. With a large volume of business, it is obvious that a great many inquiries must be cared for by letters, although it is more satisfactory for a customer to sit down at a desk and talk the matter over with an intelligent agent of the company. But the company can go further and send its agents to the customers. A person who complains of a condition, believes that he is justified; his pride or his pocketbook has been affected, and he feels that he has a real grievance; but unless a letter is favorable and contains the things he wants to hear, it will tend to aggravate the case and perhaps make conditions worse.

A personal call on a dissatisfied customer, by a representative of the management, has an important and desirable effect. The customer is impressed with the friendly attitude of the representative of the company, whom he finds a pleasant, agreeable gentleman, ready to explain intelligently all the angles of the complaint, and who shows a willingness to make any reasonable concession, or comply with any request, not as an evidence of weakness, but in a spirit of fairness, with a desire to be of real service to the customer.

The missionary work of making converts for the company in the home or office by personal calls may appear expensive, but any expense will be more than overcome by the improved public relations. Customers so approached will not only become friendly, but a matter disposed of in this manner will stay settled. To discuss a subject, man to man, face to face, is a rare opportunity of incalculable value, which invariably results in a better UNDERSTANDING.

Training, Education and Development of Personnel

Responsibility for the morale of an organization is the obligation of the management; it can ill afford to lose contact with the people who are doing the job. The human factor must be considered. There should be built up between the executives and the general forces, a line of intermediate supervision that will interpret correctly the policy of the management and pass it on to their associates.

In the past, we have distinct recollections of "drivers." In welding the bonds that should exist, to be lightly worn by both the management and employees, nothing can be accomplished by "driving." Leaders, not "drivers" will bring about your objective. Leaders that will develop loyalty and willing workers, instead of dissenters and sluggards.

Recently, more attention is paid to people coming into our industry. Special consideration is given to the selection of men and women of the highest type and to placing them in positions for which they are best adapted. First interviews are conducted by persons competent to sell the opportunities in the gas business to the prospective employee. Particular care is observed in the employment of boys and young men who, some day, will fill positions of high responsibility.

It has become a part of management policy to look after the health, safety, and welfare of employees. Arrangements are made for sick and death benefits, insur-

ance, savings, and the purchase of food, clothing, coal, coke, and so on at less than retail prices.

It is a fallacy to assume that education ends when the student completes his high school or college course. Education, in some form, is going on continually. In our own industry, various methods of instruction are in effect. Physical and mental training are essential. Salesmen, correspondents, order clerks, shop men and others who are trained only in the fundamentals of their own particular jobs, without regard to their relations with customers, can do much to injure a company's reputation.

The employee is the best source of information on the best methods of doing his job, provided he works intelligently. While on his regular job he knows exactly what should be done, too often we find that in his relations with customers he doesn't know how to put the theory into practice. He lacks tact, *finesse*. So he must get his "service selling" education to enable him to produce the desired point of contact.

Group instruction by executives is beneficial. Officers narrate the company's history, how it is financed, and its general policies. Superintendents give talks to groups made up of men and women from all departments, on such subjects as, "How gas is made and distributed," "Construction and operation of the meter," "Accounting," "Disposing of complaints," "Collections and credits," "Letter writing," "Salesmanship."

Employees are taken in groups through the manufacturing plants. Specially selected groups visit the plants of industrial companies where gas burning appliances have been installed. Lecture courses for salesmen are being conducted successfully in the subjects that interest the selling organization.

Weekly departmental meetings are of value. If it is not expedient for all employees to attend, the supervisors should be present, and they should impart any important developments to the members of their respective divisions.

Some method of interdepartmental instruction is essential in every company. All employees should be competent to talk intelligently about the gas business, not only with customers in office hours, but in social intercourse with their friends and acquaintances.

Contracts, Credits, Collections and Credit Relations with Customers

There should be as little delay as possible when the customer is asked to sign a contract. Forms can be made easy to read and easy to understand. Many companies accept applications to turn on gas and make their credit investigations later. This policy serves more than one purpose. It saves time for the customer and affords the company an opportunity to ascertain the rate at which gas is being consumed in the event that a deposit is required.

The entire structure of business is practically based on credit. Business transactions between a customer and a gas company begin with credit information. It is, of course, desirable that the first relations with a customer shall be pleasant, and still withal the company

must be protected from loss. The credit man can assist in building up good-will by being courteous and helpful to customers and by being as lenient in passing on credit matters as is consistent with good practice.

The tendency is toward a more liberal credit system. Fewer deposits are being required and they are refunded at an earlier date, provided bills have been paid promptly. Closer attention is given to the construction and tone of credit correspondence. Satisfactory credit terms must be arranged with merchandise customers in order to meet competition.

In most of the organizations the credit and collection departments are united because of the necessity for an efficient linking of the functions of the two departments.

To collect the overdue accounts, but still not offend customers, is the problem that makes the work of the collection man difficult. The credit man who is too strict loses good-will; just so does the collection man who is too drastic. At the same time the other side of the problem must be considered. Customers soon come to know which concern is indifferent and which concern will insist that its bills be met promptly. Exercising leniency to those who are *worthy* is the problem which is yours to solve. We admit we have not discovered a plan that will stand the test everywhere.

Co-ordination of Order Taking and Order Executing Departments

Our customers have come to recognize the telephone as a reliable means of communication; therefore, a large number of orders are received in this manner. Customers who telephone their orders should be treated with the utmost courtesy, for first impressions count for much in establishing friendly relations.

Our order clerks at the counter should be neat in appearance to begin with. They should be courteous, conciliatory, of pleasing personality, and ready and willing to serve. A good telephone order clerk will reflect these qualities in the tone of his voice. Order clerks must be well informed in all branches of the company's business; they should give information, but never enter into arguments or disputes with customers. Explanations should be made concisely, but clearly. Half an understanding is more harmful than no understanding. If the customer does not understand he can not be fair. And because of vanity perhaps he will not always tell you that he does not understand. Usually he has a little pride about confessing what may seem to be slowness or stupidity. These clerks should be high grade employees, as they are really service salesmen of the company.

Construction work arouses the curiosity of the average person. The foreman in charge should answer questions cheerfully. Fitters, who take time to explain the reason for changing meters periodically, will inspire confidence. Inspectors, who make investigations and adjust appliances when complaints are made about increased bills, will demonstrate the company's sincerity of purpose if they are careful to explain how gas can be used economically. Courteous, conciliatory, sincere attitudes are the seeds that will produce good-will.

In the taking of orders, no agreement should be made which cannot be fulfilled; every promise made should always be kept, emergencies, of course, excepted. It is not what we advertise and say we do that counts so much; it is the *performance* of prompt and efficient service that makes friends. The fulfillment of the order is the real test of the quality of service given.

Complaints

The principal point of contact between a company and its customers is the Bill Adjuster, or the High Bill Complaint Clerk. Men who are indifferent, forgetful, morose, and self-centered should be kept in the background. Those who are cheerful, alert and considerate will be more likely to give customers striking examples of the spirit of courtesy, fair dealing, and service, that underlie the policy of the company.

A High Bill Complaint Clerk should be a service salesman of good judgment and perfect self-control. He should be master of himself at all times. The customer may have reason for his complaint, or his grievance may be purely an imaginary one. He may make a demand for adjustment, utterly unreasonable. *He* may be at fault—not the company. The problem in any case is to re-establish his confidence in the company and win his good-will. The adjuster must make certain that his own statements have positive virtues that will establish business friendships. It is not enough that they simply have the purely negative virtue of silencing the complainant. If you maintain toward the complainant the positive virtues of patience, calmness, and courtesy, the "unreasonable customer" will, as a rule, assume a like attitude.

Letter writing is of greater importance in the High Bill Complaint Department than in any other. Since adjustment letters have to do with facts that in themselves are annoying and disagreeable, it is essential that such letters carry the proper tone. The customer should not be unduly reminded and impressed with the disagreeable features of the complaint. It is good practice to emphasize what you *can* do in the way of adjustment, rather than what you *cannot.* A courteous disposition of all the details, no matter how angry the customer may be, no matter whether his request can be granted or not, will do much toward establishing friendly relations.

The responsibility of public utility companies to state commissions for service rendered to customers, in some cities, had the effect of reducing the number of complaints. That is not to say that proper service was not given previous to Commission control, but the very fact that customers know they have the privilege of appeal to the Commission, as referee in disputes, seems to have created a feeling of greater confidence that the utility companies are operating fairly and squarely.

Recommendations and Conclusions

Specific recommendations and routines designed to improve relations with customers will be found in the sub-committee reports appended. In addition, we would recommend that closer attention be paid to the construction and tone of form letters and dictated letters.

Some companies send letters of welcome and good-will, together with pamphlets, to new customers. These letters are followed up in about ten days with

sales letters from the New Business Department.

Year after year, at our state conventions, and also at the national conventions, we make reports and read papers on the ways and means for handling complaints, but little is said about forestalling them.

It is suggested that at the next convention of this Association a committee devote its efforts to the subject of ERRORS AND THEIR PREVENTION.

The Committee believes that the gas industry, as a whole, is to be congratulated on the progress that has been made in establishing better relations with customers. Within the last decade there has come about, partly through the ownership of stock by public utility customers, a change in the attitude of the average person toward big business in general and toward such indispensable service as the public utilities provide. Gas companies, all over the country, who have been continually keeping the service idea before the public, are deserving of a full measure of credit for the gradual improvement in relations with customers.

It is not to be assumed that the millenium is here and that complaint and criticism have ceased. But our customers are becoming more discriminating, and consequently complaints are less wholesale and less unjust.

Relations with customers will, like everything else in our industry, improve in proportion to the attention given the subject. We have no ill in the gas business that cannot be cured by right thinking and hard work. The present is packed with possibilities. Safety, self-preservation, and progress lie in a coherent program for tomorrow. If the program includes careful guarding of every point of contact with customers, the reward will be a rich harvest of good-will. Good-will is inseparably linked with progress.

SUB-COMMITTEE REPORT ON DEVELOPMENT AND EDUCATION OF PERSONNEL

A. F. Short, *Chairman*, Providence, R. I.

Realizing the scope of the subject which your sub-committee on Development and Education of Personnel had to cover, we have in this paper simply hit the high spots, hoping that we may sow some seeds that will eventually bear fruit.

We first prepared the following outline of what we proposed to cover and have followed the same throughout:—

1. Selection of personnel adapted to carry out company's policies in contact with the public.
2. Development of such personnel through other departments.
3. Education of employees.
   1. Selection of personnel divided:
      - (a) Male or female clerks in various positions
      - (b) Source from which clerical help is obtained
      - (c) Requirements necessary
   2. Development of personnel divided:
      - (a) In Distribution Department, for complaint and order clerks in main offices
      - (b) In Meter Readers' Department, for collectors and general clerks in main offices
   3. Education of employees divided into two groups:
      - (a) Education within the company
      - (b) Education without the company

Under (a) we will consider—

1. Education by talks and lectures on different branches of our industry
2. Education by classes at works followed by demonstrated work
3. Education by classes at distribution department followed by actual field work
4. Education at meter repair shop
5. Value of house organ
6. Value of books and pamphlets—also posters
7. Value of literature in pay envelopes
8. Value of suggestion box

Under (b) we will consider—

1. Courses taken at schools and colleges
2. Special courses for certain classes of employees

Under 1 (a) Male or Female Clerks in Various Positions

This is a very interesting and important subject as it is directly related to our relations with our customers. Local conditions and company policy play an important part in deciding whether male or female clerks shall be employed in our offices.

In selecting clerks for our application and complaint departments and our tellers, or in fact, any of those who come in direct contact with our customers, it is

very necessary to select those in whom our customers will have the utmost confidence. We are of the opinion that in the majority of our cities our customers much prefer to do business with male clerks, especially if they have a complaint to make. It is held that the average customer is less liable to become abusive to a female clerk and that female clerks are inclined to be more sympathetic than male clerks. This is probably true in many cases, but does not the average customer really prefer to talk to the male clerk? Are they not better satisfied in the end even if the argument may have waxed warm at times? Somehow the public feels that the men in our offices rank a little higher, are a little nearer the big boss, than the women.

If the large stores in our cities have in their adjustment bureaus male clerks and the public are accustomed to talk over their grievances with such clerks, they naturally are surprised and disappointed to have to pour out their troubles to a female clerk when they come to the gas office. It makes no difference whether she is as fully competent to attend to the complaint as the male clerk or not, the fact remains that as public utilities we are here to give service to our customers as they would be served, as far as it is in our power to do so.

It is also very necessary that the clerks referred to have a complete knowledge of the work performed by the distribution department. This can best be accomplished by having the clerks accompany our fitters and complaint men in the field; not only see how the work is done, but to actually do it themselves. It is hardly reasonable to expect women to train themselves in this way, consequently, they are handicapped in the work they are called upon to perform.

The question of male or female clerks in our customer accounting offices presents a somewhat different problem. Addressograph work, filing and machine operations are probably better taken care of by women, inasmuch as they are blessed with a certain amount of patience and dexterity not found in the average man.

When it comes to selecting bookkeepers (in offices where we still keep books) and general clerks in these offices, we feel very strongly that more male clerks should be employed and that they should be paid an amount sufficiently high to attract a grade of young men who will in later years become valuable employees

How often are we at our wit's end to find male clerks capable of being promoted when a head or sub-head of a department dies or leaves our employ. Seldom do female clerks care to assume responsibility, although they may be very efficient on routine work. There are, of course, occasional exceptions. We all know what the turnover of female help is in a large office, but who can say what it costs us? Lost time is also a larger item with female than with male clerks. One of the committee admirably expressed it in these words: "With women employees their length of service is more likely to be short. They generally leave our employ when they marry and the time spent on their education is wasted. The man, if developed properly and given an opportunity with a future, will soon become permanent and an increasingly valuable investment."

Under 1 (b) Source from Which Clerical Help is Obtained

In large companies a competent employment manager is the one who carries the burden of securing new employees. Having made a study of this subject and

being familiar with all sources from which employees can be secured and having a perfected system, the class of employees secured in the larger companies by the employment manager should be of high calibre.

The majority of the companies are not, however, large enough to warrant the expense of maintaining such a separate department, and the securing of new employees is usually left to the heads of the various departments. High schools, business colleges and trade schools are sources which are drawn on to a large extent. If employees are to be drawn from such sources, the idea of, in some way, presenting to the students of these schools, the opportunities offered by our industry is well worth our serious consideration. There are at least three ways to accomplish this.

First: By addresses before the students by a capable official of the company.

Second: By having classes visit our plants and show them just what a gas plant is and how it functions.

Third: By using every means possible to have courses relating to the manufacture and distribution of gas, established in our schools and colleges.

Clerks in our offices frequently know of some friend or acquaintance who would like to become one of our employees, and if our clerks are satisfied with their work they will not be backward in persuading others to join them in our offices.

To draw the better class of employees we must prove that we have an attractive proposition to offer, something well worth while, and we must follow it up by promotion when deserved. If the company is not large enough to advance employees when they are capable of filling better and more responsible positions, then we should use our best efforts to place them in larger companies where their ability will be rewarded. Thus the smaller companies would become the training schools for the benefit of the gas industry as a whole.

If it is generally known that ability and faithfulness will be rewarded, the better class of applicants will be anxious to become our employees, and the task of securing them will be made much easier for all of us.

Under 1 (c) Requirements Necessary

First of all we should select employees who can control their tempers, no matter what provocation may arise. No matter what their other qualifications might be, they will get us into trouble sooner or later if this one qualification is lacking. Courtesy, diplomacy and the art of knowing what and what not to talk about are valuable requisites.

It is preferable to secure employees who have had a fair amount of schooling and have acquired the fundamentals upon which to build. This will be reflected later in any educational work we may undertake. Too often we pick employees with only one thought in mind, and that is, can they fill this or that position. Too late we find when a chance for promotion comes that they have one-track minds and that all-around ability is lacking. Many times we find clerks doing unsatisfactory work in one department and by ascertaining, through direct questioning or through the department heads, what branch of the work most interests such employees, we are able to place them in positions for which they are best fitted.

Employees who come in contact with the public must be of pleasing personality. A harsh voice or an abrupt manner is fatal to the success of any clerk. We must remember that the great majority of our customers come to our office to register a complaint, perhaps only once, and their opinions of our entire organization are formed by the treatment accorded them and the amount of individuality our representative injects into the case.

Under 2 (a and b) Development of Personnel

In selecting employees in our distribution office thought should be given to the fact that these employees should be of such calibre that they may be drawn upon to fill vacancies in our accounting and commercial offices. Their experience in the distribution work will be of great value in their contact with the public. An exchange of clerks between these departments for a period of sufficient length to enable them to become thoroughly familiar with the workings of each department is advised. Likewise, meter readers, if properly selected, can be promoted to the collection and bookkeeping departments.

Under 3 (a) Education of Employees Within Company

The education of our employees is a big task and should receive much more attention by us than is now the case. Education of employees will cost us real money and at times will be a discouraging proposition. If one means of education does not avail, then we must try some other means. Education of employees is constant and is never finished.

Your Committee considered that education within the company was of sufficient magnitude; therefore, we concentrated more particularly upon this phase of educational work.

Under 3 (a-1) Education by Talks and Lectures

The following are suggested as being subjects which would be of benefit to employees provided they can be made interesting.

1. History of Company:

In the older companies probably few of our employees know anything of the past history of the company. A very interesting talk could be given, tracing the growth of the company from the beginning, showing progress made. In a talk of this kind, statistics should be avoided as much as possible.

2. How Company Is Financed

This is another subject of which most of our employees have but a faint conception and upon which they should receive enlightenment.

3. The Manufacture of Gas

More of a general talk than any which might be given in connection with class work of any kind.

4. Interesting and Novel Industrial Installations

All of us have many such installations that would be a revelation to our employees. To a large degree they have no conception of the many ways gas is used for industrial purposes.

5. The Distribution System

Explain the general layout of mains, services; how pressures are carried and maintained; the difference between high and low pressure systems and the many problems constantly being solved.

6. Complaints

How complaints of all kinds are handled and what it means to satisfy customers.

7. How Gas Accounts Are Kept

Complete outline of work done in the accounting office, from reading of meter to payment of bill.

8. Future of Gas Industry

The idea being to dispel any thought that might be lurking in our employees' minds that the gas industry is on its last legs.

Under 3

(a-2) Classes at works followed by demonstration work

(a-3) Classes at Distribution Department

(a-4) Classes at Meter Repair Shop

Courses as outlined above will depend upon the facilities available in the different companies. The course at the plant will necessarily be more elaborate than the other two.

A suggestion for a course at the plant is as follows:

Have groups of employees given at least two complete days at the plant, one day to be devoted to coal gas manufacture, and one day to water gas manufacture in companies where coal and water gas are manufactured. Each morning have class work and follow up in the afternoon by tour of the plant. If space is available, the class room should have a blackboard at one end on which should be drawn a cross section of the coal gas plant, carburetted blue gas plant and a house boiler. This should be drawn with colored chalk to resemble as far as possible the actual buildings at the plant. This will make it easier for our employees to fix things in their minds during the tour of the plant.

In the distribution department apparatus can be installed showing plugged house-piping, small, inadequate house-piping and condensation in pipes, and the effect they have on a proper flow of gas. Customers are prone to complain of "poor gas" when in nearly every case the fault lies in poor pressure occasioned either by plugged supply pipe or by small or obstructed house-piping, usually the latter. If the flow of water is small in their homes they never complain of "poor water," but know instinctively that it is the pressure that is lacking. Why not educate our employees along this line that they may do a little missionary work among the public?

In the meter repair shop the workings of a meter can be shown and the testing of meters fully explained. Impress upon our employees the fact that gas meters are very efficient measuring machines, and that the majority run slow rather than fast.

Instruction in the distribution department should be followed by employees going into the field, not only to see the different kinds of work performed but actually to do it themselves.

The question naturally arises as to whether it is necessary to give all employees the foregoing instruction and field work. While the amount of benefit derived is varied and while, as stated before, our female employees can hardly be expected to take all of these courses, those who are able to familiarize themselves with all company activities will be better employees for having done so.

All clerks who come in contact with the public should know the fundamental

principles of gas manufacture; how complaints are handled by the shop; how meters are set; how appliances are connected; how house-piping is cleaned and how meters are tested. They should be able to answer intelligently questions asked by customers. "I don't know" is a poor answer for any employee of a public utility to make to a customer. The switchboard operators should be familiar with the workings of each department so that connections may be speedily and properly made. They should be taken to each department and introduced to those with whom they will come in contact most. They will thus be able to visualize each call and thereby become far more efficient operators.

Distribution employees should know the manufacturing end and the plant men the distribution end of our business. Appliance salesmen should be especially trained in every branch of the industry.

Care should be taken to simplify the class work and keep away from technicalities as much as possible. Make the class work interesting. Clear and concise explanations of the class work as the employees are being taken through the plant or in the field is more effective than too much or too complicated class work and too little demonstration. We remember things we see better than things we hear or read about.

Under 3 (a-5) Value of House Organ

The house organ affords a splendid means of placing before our employees things they should know about their own company and about the industry at large. Many of the larger companies are publishing house organs, and while the degree of success is varied, undoubtedly a large percentage of employees receiving them are greatly benefited. In large companies it is much easier to succeed with such a publication because of the large number of employees to draw on for suggestions and interesting articles. In the smaller companies the whole secret of a snappy, interesting house organ lies in the right fellow having charge of it. This also applies to a considerable extent to the larger companies, as no matter what material may be furnished the editor of the paper, it has got to be put out in attractive form. We feel that unless you are able to put out a real live publication each month and keep it so, better let it alone.

Under 3 (a-6) Value of Books, Pamphlets and Posters

The value of distributing books and pamphlets as such is open to question, and it would seem better, if possible, that reprints be made as emanating from the company. If we maintain a library for the use of our employees, books and pamphlets pertaining to the gas industry should be accessible to every employee of the company. The best trade papers should be circulated among the employees, especially among the heads and subheads of departments.

Posters, as a general thing, fall very short of accomplishing what we anticipate. They are, as a rule, expensive and it is our belief that this money can be expended in other means of education to far better advantage. This does not apply to the National Safety Posters.

Under 3 (a-7) Value of Literature in Pay Envelopes

Literature in any form should be kept out of pay envelopes. Other means should be used for placing educational matter in the hands of our employees.

Under 3 (a-8) Value of Suggestion Box

If enough interest can be aroused in it this is a very valuable means of ascertaining from our employees their views on a wide range of gas company activities. As a means of arousing interest, prizes could be given to employees making the most valuable suggestions. Companies who have tried the suggestion box have, as a rule, been well repaid for their efforts.

The task of educating the higher grade of employees is much more simple than the education of the rank and file. The education of this latter class should give us the greater concern, as they are the ones who come in daily contact with the class of customers who cause us the most trouble, through ignorance of the function of a public utility.

Under 3 (b-1 & 2) Education Without Company

This will only be touched upon briefly, as it seems that much more can be accomplished by education within the company. Employees who enter our employ should have received a sufficient amount of general education, before coming to us, to make it unnecessary for companies to arrange for such general education. Education without the company should be confined to special instruction which will better fit the employee to carry out company policies and practices. Generally speaking, education outside the company should be for specific purposes and should be given only to employees who are keen for it. It is a great mistake and a waste of money to compel employees to take prescribed courses in schools and universities. To those desiring to take advantage of the opportunities offered by such courses, the company should directly or indirectly see to it that the employees are reimbursed for their time and expense. Many of the companies offer to their employees such an opportunity and are meeting with varying success; some companies report marked interest in these courses by employees, while others frankly admit their disappointment with the results. It would seem as though a great deal which is included in the courses given in the schools and universities could be worked out and given by instructors in the company with much better results.

There is, however, one branch of our activities where a thorough outside course should by all means be given. We refer to the education of the industrial salesmen. These men are thrown into daily contact with highly technical men in other lines of business and it is of the utmost importance that such men should be trained to the minute. The possibilities offered gas companies in the industrial field have hardly been scratched, and with men fully competent to handle this branch of our business we have a bright future before us. We understand that the Massachusetts Institute of Technology has a complete course which fits men for just this kind of work, and it is probable that other similar institutions are as well equipped. We urge every company to seriously consider giving their industrial salesmen the best education obtainable. Money spent in this way will be repaid to us manifold in the future.

In conclusion we should impress upon our employees that a public utility is a collective effort of community usefulness; that every one of them is an important cog in the wheel and that it is their company. If they are familiar with every branch of the work, believe in their company, talk about it, and work faithfully for its success, then gradually our efforts will be rewarded not only by a more intelligent and efficient corps of employees but also by a better under-

standing of the gas industry by the public,—the real goal of all our educational work.

Appendix A

Educational work of some of the companies is as follows:

Consolidated Gas Company of New York

Manufacturing Department

Individual training of new men in the proper performance of the mechanical work in which they are engaged.

Mains and Service Department

Employees are instructed in the proper method of installing and repairing mains and services.

Fitting Department

Instruction is given to all new employees, and to many of the old ones, in the mechanical branches of the work. Attendance at the classes which are held during business hours is compulsory.

Meter and Appliance Repair Shop

Instruction is given to all men in meter repairing who have soldering experience. Classes are conducted during business hours and attendance is compulsory.

Commercial Department

Meetings of an educational nature are held by the employees of the Industrial, Domestic, Hotel and Lighting Divisions. Instructions are given on various classes of gas fuel and gas illuminating appliances. From time to time general meetings of the entire sales organization are held for discussion of both fuel and lighting appliances.

Employees of the Commercial Distribution Department are receiving, at the Branch Offices, thorough instruction on all classes of appliances, adjustment of burners, replacement and exchange of parts, etc.

Utilization Department

The engineers instruct classes in the various divisions of the Commercial and Fitting Departments, and are frequently called upon to lecture before the Engineering Societies, public schools, and other public gatherings.

Accountancy Course

Nearly 88% of the employees of the Accounting Department of the allied gas companies are enrolled in the Three Year Accountancy course which for several years has been conducted.

Society of Gas Engineering of New York City

The monthly meetings of the Society of Gas Engineering of New York City are largely of an educational nature, the meetings being devoted to the presentation of subjects related to the development of the science of gas production, distribution, construction and utilization.

Peoples Gas Light & Coke Company of Chicago

Training and Education

1. Employees' Training and Education *Record.*
2. Follow-up on *subjects studied.*
3. Follow-up on minors and employees interested in particular subjects.
4. Advice on subjects and schools.

Ten men enrolled in the new course at Northwestern University, "Business and Government."

Classes

English & Civics for foreign born
6 classes—220 men—twice a week

Meter Repairers
1 class—35 men—1-2 a week

Accounting
1 class—2 a week

Correspondence Instruction by Correspondence Adviser
a. Correspondence Department—once a week—15 minutes
b. Dictators and Understudy Correspondents — twice a month — 1 hour.

Economics—1 class—once a week.

First Aid—(2 classes at shops and stations organized by safety supervisor and taught by company doctor.)

Heating (House and Water) for Sales Engineers.

"Our Company as a Public Utility," a series of 10 lectures on public utility problems by Ralph Heilman, Dean of Northwestern University, School of Commerce.

Departmental

Application Department — Twice a week and a study of shop practice, meter reading and salesmanship.

Bookkeeping Department—Once a day.

Collection Department—Once a day.

Investigation Department—Once a week.

Literature

How Carburetted Water Gas is Made. (5 pages.)

Diagrammatic Chart, How Carburetted Water Gas is Made.

How the Spirit in Coal Becomes the Good Fairy in the Household and the Giant Service in Industry (32 pages).

History and Development of the Gas Industry (32 pages).

The Romance of the Gas Industry (203 pages).

Catalogs and Circulars of Educational Institutions.

Employee's Guide Book.

Company's Advertising Booklets:—
Gas Man Makes a Call; When It's Your Move.

Mimeographed Bulletins

Better Letters.
Correspondence Instruction.
Engineering Literature—Abstracts for Engineers.
Minutes of Investigation Department.
Our Company as a Public Utility.
Practical Sales Instruction (Heating).
Sabeanisms for Salesmen.
Truth Concerning Public Utilities.

Library

(Reference and Circulation)

February, 1923—	Books	473
	Magazines	1173

Motion Picture "Breakfast Ready, Dear."
Laying gas mains and running service pipe.
Repairing meters; breakfast scene.

Training and Education Division encourages employees to take advantage of courses in local educational institutions.

Effective Speaking

Three classes after hours for superintendents and employees, 10 weekly meetings.

First Aid

For men and women, conducted by the Medical Department.

Hygiene for Women

Under auspices of the American Red Cross.

Sewing and Dressmaking, Millinery

To raise the purchasing value of a dollar and to inculcate understanding of and appropriateness of dress.

Visits to Stations

Employees invited to visit manufacturing stations on Saturday afternoons to see how gas is made.

Gas Utilization Visits

Superintendents and assistants taken to representative industrial plants to see at first hand how and where gas is used.

Public Schools

a. Instructor for Continuation School spent 8 weeks in company's departments with view of acquiring practical business information useful to school children.

b. Window exhibit on gas making materials and resultant products donated to Technical High School.

CONSOLIDATED GAS, ELECTRIC LIGHT & POWER CO. OF BALTIMORE

General educational program in the public schools, City College, Polytechnic Institute, Y. M. C. A., University of Maryland, business colleges, Johns Hopkins University and N. E. L. A. correspondence courses.

Other Educational Work

All departments hold one monthly meeting during the winter months at which an outside speaker addresses the group on some subject in connection with their work, or there is presented a paper prepared by a member of the department. Discussions are in order, the meetings usually lasting one and a half to one and three quarter hours.

Educational work of the General Service Departments' employees consists of a study of a manual on rate schedules, policies and practices; a course of about three weeks through these departments whose work brings them actively in contact with the public, such as complaints, setting of meters, fitting, distribution, meter readings, etc., they spending 1 to 3 days in each department, according to its importance. During this period, they go out on the wagon with the meter setters and actually help in the placing of meters; and they also go out with the complaint men and assist in that work for the experience. These courses are usually held in the duller seasons and are repeated each year, so as to keep the men up to date. Meetings are held once a week at 9:30 in the morning, when a representative of each group meets in the office for constructive criticism and discussion of what has come up in the past week. Members attend alternately weekly, so that each member of the department has an opportunity to make suggestions or constructive criticism. In this manner they are made to feel that each man is a part and parcel of the organization and has the opportunity to express his personal views.

The heads of departments coming directly in contact with the public, hold what are termed "Service Meetings" every third week for the purpose of exchanging ideas and suggesting changes in policies. The subjects are those brought to the superintendent's attention through his departments and these meetings have had the effect of not only weeding out the bad spots which antagonize the public, but have materially effected the service idea through the organization.

ROCHESTER GAS AND ELECTRIC CORPORATION OF ROCHESTER, N. Y.

Educational work is divided into meetings and publications. A general meeting of the management and major executives is held weekly for the discussion of all company problems. Similar meetings are held monthly in each company department in which the information and instruction received in the weekly meetings is transmitted and in which the operating problems in the department concerned are thoroughly gone over. These latter meetings include all men having responsible charge of others, together with some of the better workmen.

The company publishes a monthly magazine which treats of all matters of company interest. It issues weekly other bulletins on safety and other matters. It extensively advertises through the local press, information of value, not only to the general public, but to its employees. It has recently conducted a very elaborate prize essay contest based on advertisements concerning the company and

its business, in which the children of the company employees participated.

The company further subscribes to the standard courses sold by the N. E. L. A., the American Gas Association and others, permitting the employees who take the course to refund the purchase price under reasonable conditions.

The company is holding meetings for the spread of information on company business to local stockholders. These are open to company employees who are stockholders.

Each operating department has fundamental rules for conducting the work of the department, which are revised as necessary and are quite generally issued. An endeavor is also made by the foremen and employees to spread educational information through general business intercourse.

Empire Gas & Electric Company of Geneva, N. Y.

Two years ago a study-lecture course of ten lessons and twelve lectures, following somewhat closely the Sheldon School Course, was instituted. Employees were divided into convenient groups of classes and one hour each week was devoted to the lecture on the lessons which were supposed to have been read by the employees before class time. The attendance on these classes was on company time, and obligatory; and at the end of the class period each week a written review of the work for that particular class period was required.

The Vice-President and General Manager. Mr. H. O. Palmer, in company with the lecturer, Mr. Loyal S. Wright, edited ten lessons, each lesson contained in an individual pamphlet, on the general subject of "Serving the Public." These ten lessons or pamphlets comprised the text books used in the course.

A record was kept on each employee, showing his attendance and class record. This study-lecture course worked out very nicely and at the present time new employees are taken in hand by the local superintendent-manager, or some other suitably equipped person in the company, and the substance of these text books is gone over carefully with the new employee.

They are contemplating and will put into effect as soon as suitable arrangements can be made, simple courses in gas fitting, generation and distribution of electric current. It is their intention to have the text book used in these elementary courses prepared by the heads of departments concerned and finally establish a school with classes covering all lines of public utility work, making it compulsory for a new employee to pass through the branch of the school he is more concerned in before he becomes a permanent employee of the company.

Boston Consolidated Gas Company of Boston

The Boston Consolidated Gas Company has established an institute for educational work as outlined below.

Purpose

The purpose of the Boston Consolidated Gas Company Institute is to provide specialized instruction for certain employees of the company.

The courses selected are all planned with consideration to the general education and experience of employees. Whatever the particular interests of an employee may be, he will be able to find, among the courses offered, one that will help him to do better work and add to his general ability, to his knowledge and to his character.

Method of Selection

Employees are allowed to choose (with advice of superintendent) a course from the list outlined in the bulletin. Owing to exigencies of the business, the number of students attending the second term must be reduced from the present 700 pupils to about 400. Those who are not allowed to continue for the second term may have another opportunity when the classes are resumed in the fall.

Hours of Classes

All classes consist of fifteen one-hour sessions; fourteen regular class periods and the examination period. Courses run one hour a week, either 9 to 10 in the morning or 4 to 5 in the afternoon. The classes, therefore, are given in the company's time.

Approved Courses

Approved lists of courses will be offered twice a year; in September and February. All students who are allowed to continue may elect a new course in the next term. Thus, any employee who really wishes to secure a broad, practical education or collegiate grade has the opportunity to do so.

Cost of Courses

The cost of the course is paid by the company. There is no cost to the employee except for text books or working material.

The Faculty

The Boston Consolidated Gas Company has made arrangements with the College of Business Administration of Boston University to prepare, conduct and supervise all of the courses for the Boston Consolidated Gas Company Institute. Each course will be given by the member of the C. B. A. faculty who teaches the same subject to the regular college students.

The employees are, therefore, able to receive instructions from the educational authorities of whom there is no better. The calibre of the work is equal in every respect to that of the finest college in the country.

The courses are all conducted under the supervision of Professor Harold Whitehead, head of the Department of Sales Relations.

Certificate

All students satisfactorily passing the courses for which they registered will be awarded a certificate issued jointly by the Boston Consolidated Gas Company Institute and the College of Business Administration of Boston University.

This certificate will be signed by Dean Everett W. Lord of the College of Business Administration and by Mr. D. D. Barnum, president of the Boston Consolidated Gas Company.

An Educational Opportunity

It will be seen that this educational opportunity helps employees to make bigger and better men and women of themselves. When the company is seeking executives, it will consider educational progress as well as general character and the ability to get results. This educational program will, therefore, be a direct help to ambitious men and women, for their class work will provide an index to their desire for betterment.

The company reserves the right to close this educational work at the end of any term if, in its judgment, the class of work done and the results obtained from it do not justify the expense.

It also reserves the right to withdraw the educational privilege from any employee who may not be measuring up to the high standard which it sets for its employees.

The Educational Program is a privilege that must be worked for to attain and worked for to maintain.

Outline of Course

Elementary Economics.
Bookkeeping.
Introduction to Accounting.
Salesmanship.
Personal and Business Efficiency.
English Composition.
Speech Training.
Operating Control.
Chemical History of Gas Industry.
Free Hand Drawing.

WORCESTER GAS LIGHT COMPANY OF WORCESTER, MASS.

Employees are given instruction at the plant similar to that given in Providence.

The Y. M. C. A. of Worcester is connected with the Northeastern University and has a high grade school of commerce and finance and young men are encouraged to take this course.

Talks are given occasionally on subjects of interest to the employee.

Bulletin boards are maintained in each department and general information about the company posted thereon.

The suggestion box has been kept a vital part of the organization and a bonus given for valuable suggestions.

Providence Gas Company, Providence, Rhode Island

Educational work has been confined chiefly to education of employees at the plant; outline of this work is as follows:

Procedure of Educational Work at Plant

Groups of from eight to twelve employees were given two complete days of instruction and sight-seeing at the plant. The employees assembled in the so-called class room at the main office of the building, which room is approximately fifteen feet square. One end of the room was converted into a blackboard by painting the wall with blackboard paint. On this wall was drawn a cross section of the coal gas plant, carburetted blue gas plant, and a house boiler. The drawing was done in colored chalk. An attempt was made, as far as possible, to make the building resemble the actual buildings located at our plant, so that the connection between the cross section on the board and the actual buildings on the outside would be brought home to the employees on their trip around the plant, after receiving instruction in the class room. By the use of colored crayon, it was possible to indicate a change in the color of the gas as the gas went through its various processes. For instance, as the gas left the tar extractor the color was changed from brown to green, brown indicating the presence of tar up to that point, and green indicating that the gas still contained ammonia. After the ammonia was removed, the color of the gas was changed to yellow to indicate that the sulphur was yet to be removed, etc. On tables in the class room were laid out samples of coal, oxide, tar, ammonia, gas oil, etc., so that the speaker could illustrate his talk with the actual substances connected with the manufacture of the gases. A gas meter was also shown here, the meter being so constructed that it could be slit apart and the function of metering gas easily shown. At the back of the class room was located an exhibit of piping connected to gas lights, heaters, etc. By means of three inlets—one through a plain pipe; one through a glass tube containing deposits from house-piping and one through a glass tube on an angle containing water, indicating the condensate condition—it was possible to show the effect on burners and heaters when deposits existed in house pipes and when water seals existed in house pipes.

The first day of instruction consisted of a talk (not a lecture) on the manufacture of coal gas. This talk started at approximately 8:30 and continued until 12 o'clock with an intermission of five minutes at 10:30. The talk was very informal, questions being invited during the talk and further questions invited after the talk. The instructor in turn took the opportunity at various times to question the employees in order to obtain an idea as to whether they were absorbing the instruction. The basis of this talk was the following outline:

Talk I—Coal Gas

Formation of Coal by Nature.
Formation of Coke by Man.
Murdock's Discovery—1792.
History of Coal Gas to Date.
Providence Coal Gas Practice.

1. Characteristics of High and Low Volatile.
2. Preparation and Mixing of Coals.
3. Retort Practice of Coal Preparation.
4. Ovens.
5. Coke Handling.
6. Condenser House.
7. Purification.
8. Metering of Gas.
9. Storing of Gas.
10. Distribution of Gas.
11. Quality of Gas.

At 12 o'clock the class was dismissed until 1 o'clock, at which time it was taken through the plant and shown in detail

what it was told about in the class room in the morning. This trip through the plant continued until about 4 o'clock, the employees being at liberty to spend the remaining time in any part of the plant they desired.

The second day of instruction consisted of a talk on the manufacture of water gas, the past, present and future of gas lighting and the value and use of coke. A general outline of these talks is as follows:

Talk II—Water Gas

Reasons for Combined Plant.
Lack of By-products in Water Gas.
Water Gas Reactions.
Generator House.

1. Blue Gas.
2. Oil Gas.
3. B.t.u. of Gas.
4. Removal of Tar.

Purification.
Metering, Mixing and Storing.
Water in Gas—How and Why?
Control of Quality.

Lighting

1. Past.
2. Present.
3. Future.
4. City Protection.
5. Open Flame vs. Carbon Lamp.
6. Eyes.

Coke

History.
Manufacture.
Value.
How to Burn Coke.

The routine of the second day was practically the same as that of the first.

Appendix B

Companies issuing house organs are as follows:

Holding Company House Organs

Title of Magazine	Company	Address
Bulletin	Pacific Power & Light Co.	Portland, Ore.
Here We Are	Georgia Ry. & Power Co.	Atlanta, Ga.
Public Service Lumen	Public Service Co. of Northern Illinois, 72 West Adams St.	Chicago, Ill.
Doherty News	H. L. Doherty & Co., 60 Wall St.	New York
Pacific Service Magazine	Pacific Gas & Elec. Co.	San Francisco
U. G. I. Circle	The U. G. I. Company	Philadelphia
The Empire News	Empire Gas & Elec. Co.	Geneva, N. Y.
Tenney Service	C. H. Tenney & Co.	Boston

Individual Gas Company House Organs

Gas Logic	Cons. Gas Co. of N. Y.	New York
Peoples Gas Club News	Peoples Gas Lt. & Coke Co.	Chicago
Texas Utility News	Texas Power & Light Co.	Dallas, Tex.
Glow	San Diego Cons. Gas & Elec. Co.	San Diego, Calif.
The Southern Public Utilities	So. Public Utilities Co.	Charlotte, N. C.
Current News	St. Paul Gas Light Co.	St. Paul, Minn.
Gas & Electric News	Rochester Gas & Elec. Corp.	Rochester, N. Y.
Gas Service	Kings County Lighting Co.	Brooklyn, N. Y.
Gas & Electric News	Cons. Gas, Elec. Lt. & Power Co.	Baltimore, Md.
The Bulletin	Central Hudson Gas & Elec. Co.	Poughkeepsie, N. Y.
The General Engrg. News	General Engineering & Mgt. Co.	New York
Gasco Bulletin	Portland Gas & Coke Co.	Portland, Ore.
The Gas Magazine	The Ohio Fuel Gas Co.	Columbus, Ohio
Public Service News	Public Service Corp.	Newark, N. J.
By the Way	Syracuse Lighting Co.	Syracuse, N. Y.

SUB-COMMITTEE REPORT ON CREDIT AND COLLECTION POLICIES AND CONTRACTUAL RELATIONS WITH CUSTOMERS

J. M. Roberts, *Chairman,* Chicago, Ill.

This subject is so weighty, the field of endeavor so large, and the individual requirements of the various companies which compose our industry so manifold, that your committee has set up only principles—not routines.

Your sub-committee on credit and collection policies and contractual relations with customers has considered the general collection and credit policies of company members from the broad viewpoint of their effect on our customers' attitude and their influence in promoting and retaining good will. In the main, to gain our customers' co-operation is our attainment.

If we can establish that which we are seeking, we shall influence and increase our new business, and particularly stimulate merchandising; but some of us must not bob our heads in assent, and then forget and follow our old ways, as exemplified in the story of the London pieman who called loudly from his corner, "*Hot* mince pies! *Hot* mince pies!" A woman buying one found it stone cold, and said, "My man, did you not call *hot* mince pies?" He answered, "Yes, lady, but they are not hot, that's just the name of 'em."

Let us not talk sagely of desires for the right kind of relations with our customers and merely consider them as a subject for discussion and then allow our ardor to cool off. Warm up your subject. Get it red hot—even cold iron can be heated so that it will flow.

We have endeavored, in our work, to embrace the whole field of contractual relations with customers with our original thought, service and good will, always foremost. Emphasizing the desirability of point of contact with customers when taking contracts, and obtaining signatures to any papers that are included in the wide range of main contracts down to selling the smallest type of appliance.

Unnecessary restriction of service to customers, owing to present credit practices, should be discarded. The simplification of forms and routines connected with our service to customers should be carefully considered.

We submit and emphasize that two dominant features should be outstanding in all our transactions with our customers—courtesy and efficiency.

We are the salesmen of our industry, like the salesmen of the great mercantile houses of today, and in some respects some of our companies do not follow, but lead. If we have to follow, let it be in the wake that is left by high-class merchandise houses and not those of the technician or the lawyer.

Your committee recommends that we should at least speak a common language that will be intelligible, not only to com-

pany workers, but to our patrons, and eliminate technical words and phrases in our contracts and papers presented to customers for signature.

In our investigations, we found that a number of companies have formed or rather have set a pace that it is going to be hard for their associate companies to follow. Those companies, that are fortunately so progressive, are cautioned to live up to the reputations established. For it is easy to give but hard to take away prompt rendition of any service embodied in their policies, or to justify any restriction of gratuitous work.

Routines should be subordinated to principles, for if we can establish principles that are acceptable in the main, such principles can be easily modified to suit local conditions.

Because times, minds and conditions change the work in which we are engaged, that which has been gone over in various ways heretofore, will never be a finished product.

Individually, we are engaged in a science that is comparable to the engineer's or chemist's. They do not attempt their fabrication or process until, after repeated trials and tests, they have decided what results they can obtain. They then carefully plan their objective. All materials used in building and establishing the ultimate end have been carefully gone over; analyses have been made and tests conducted that give them the assurance that the materials to be used are up to a definite standard.

But men in the engineering profession have a distinct advantage in their field, that we in our contacts with customers have not. When they make analyses, reactions take place that give them the assurance that they have the proper standards and formulas for their tests, and when tests have been completed, they have an assurance that we have not. Figures can be revised and checked until they know positively what their floor areas and walls will stand in the way of weight and windage, and what their processes will do, and then what?

Consider length of life; the result of all engineering is only of short duration, and your engineers know this; as a consequence, they are planning all the time to replace, renew, and improve. We are, or should be, in an identical position, but we are dealing with a more complicated structure—the human mind—which is, in the aggregate form, public opinion. Anything we do or say, or any policy we may apply, brings about the reaction which is our test. But how skilful we must be to see that we always have our tests and analyses under control and how alert we must be to improve, reject, amplify, and perhaps withdraw altogether from the structure of our relations with customers any part of our contractual policies that is not fitted for its purpose, bearing in mind that all our engineering is done with the human element, and that it is a very dangerous element to experiment with. Nevertheless, we must continue, for that which we build today will not serve permanently.

Contracts

The thought has been presented on several occasions that it is possible to eliminate so-called applications for gas or contracts and other forms of agreement. This is to your committee's mind a revolutionary proposition.

The majority of our customers will have more respect for our companies, believe in them, and invest in them more

readily if they know our companies were reasonably and properly protecting themselves, and at the same time, giving the best possible service and accommodation to their customers.

The point of contact. We have heard this so often we all know what it means. Nevertheless how often we overlook it. What point of contact can be obtained in customer that asks for the original installation and very recently some companies in agreement with our thought have changed their policy on this subject.

How do companies who use prepayment meters get their money? What is their contract? What is their point of contact? Nothing! Gas business transacted in this manner is but a cold dollars-

APPLICATION FOR GAS METER

ORDER NO. E704414

DATE CUT OFF OR CUT OFF ISSUED

TAKEN BY LBM

PHONE NO. Wabash 3402

ADDRESS 6714 So Michigan Av.

FLOOR LOCATION 2- Apt. K.

LAST SUPPLIED New Consumer FL.

NAME Amos Smith

(IF NEW CONSUMER) EMPLOYED BY McHenry Bros.

ADDRESS 122 So Michigan AS Supt.

REFERENCE James B Smith

ADDRESS 6528 Wabash Av

OCCUPIED AS* Apt

KEY FOR PREMISES Open

ARE APPLIANCES CONNECTED YES ☒ NO ☐

$ DEPOSIT NUMBER

DATE

LEDGER NO. PAGE

DIST. NO. FOLIO

EXECUTE T. O. CR SET 7/21

*If domestic consumption designate as flat, residence, rooming or boarding house, basement, hall, private barn or garage; if store, shop, factory or office, give nature of business and whether manufacturing, wholesale or retail.

6

The subscriber hereby applies for gas to be supplied by the Company at the above described premises, or at any other premises in addition thereto or in lieu thereof that the subscriber may hereafter designate, and agrees to pay for said gas so supplied, until such time as the Company is notified by the subscriber to discontinue the supply of gas, at the rates and in accordance with the service rules applicable thereto approved from time to time by the Illinois Commerce Commission.

The subscriber further agrees that the meter furnished by the Company is, and shall remain, the property of the Company, and that the Company's agents shall have access to the meter at all times, to read, repair, lock off, seal or remove the same.

SIGNED Amos Smith (SEAL)

FORM 6 This application is taken subject to approval of the Credit and Collection Department.

Form A

Actual Size 7¾" x 5"

doing away with contracts? None. The contract is eliminated and a point of contact lost. Invariably the company members that were approached with this thought, expressed their negation.

Companies that use prepayment meters might be in concert with the idea of disposing with contracts. But your committee does not recommend the use of prepayment meters. Because usually no effort is made to get a contract from a customer supplied through such meter, or from the numerous successors to the and-cents proposition, which seems contrary to the present-day methods of doing business.

If you do away with your applications for gas, you might as well do away with your credit department. If you do away with your credit department and its credit information, from whom are you going to collect your final bills?

The Application Department, Credit Department, and Collection Department should co-operate. Why co-operation?

Because of the information necessary to make collection of your final bills. In larger companies these departments are divided, but in smaller companies this group is usually one department.

More employees who come in contact with our customers should be able to take ordinary contracts, such as gas applications, jobbing orders, and merchandise sales, thereby giving the customer service in saving him time by relieving him of a call at the general offices of the company. But all contracts should be subject to approval by the credit department.

If gas is turned on before credit investigation is made, the contract should be in the office of the credit department the day after the order is executed.

Consider your application for gas; it is most important. A form that we think is ideal in its makeup is shown. A simple form carrying all that is needed as to legal obligations.

You will note its construction is very simple. There is very little reading matter for the customer to peruse and it is clean-cut, readable, and must have a good effect on the customer. The reverse of this form is blank and may be used for credit reports.

The customer's name should be hand lettered and not written, and this should not be printed until after the customer has signed the application. You will then be sure of having the correct name, and all records built up from this application, will then be in accord with the proper spelling of the name.

If you take orders over the telephone to turn on gas, of course, you have not a signed contract until your inspector calls and gets it when he executes the order; then care should be exercised in checking the spelling of the name with the signature before such orders are permitted to become a matter of record.

Credits

If we are to hold to our text, we must assume that service is the first requisite in the establishment of good relations with our customers, and it must be not an indefinite wabbly policy but an extensive one.

To prove the value of such service, you have but to go to some city, where there is not only a rivalry between the electric and gas companies but also a different management. If one serves its customers better than the other, it will not be long before the other will begin to lose friends in such a pronounced manner that it will quickly line up with the more liberal policy established by its competitor.

When the final results are obtained, provided the credit department is properly functioning, the change to the more liberal service is not reflected disadvantageously in the balance sheet.

The credit department should be dominant and vigorous in its control of all new accounts. If it is not, its lack of purpose will later be reflected in the percentage of loss shown in collections.

By being vigorous and acting with rapidity and purpose does not mean that the credit department should be harsh or hasty. Members of this department should be alert and know their psychology. The department should not be a stone crusher, but rather a conveyor, carrying on to our records as quickly as possible the good accounts, and tripping off, as they pass along, the questionable ones that show a customer who requires analysis concerning his integrity and responsibility.

We must first obtain proper information concerning our prospective customer, and to get this certain questions must be asked that should be couched so they will not appear offensive.

No stranger applying for gas who has used gas in another town or city, will take exception to a request for information as to where he last used gas, no matter what his social or financial standing. No one can establish a credit account with any concern without first submitting to certain inquiries. Neither should affront be taken by a prospective customer to the question of references by a gas company, or to the effort of the application clerk in an endeavor to be assured that the correct spelling of the name is on record.

Contrary to some beliefs, your new customer looks with more approbation on the company if it is business-like in its first transactions with him.

Now we are satisfied if credit relations have been properly established and the necessary classifications made of your accounts, which should be sifted into their three relative positions, good, bad, and questionable. You are then ready for the further sifting of the last two. Some may require street investigation, or the telephone might be used to get required information that will assist in passing on credit. The remainder, after all this sifting, are the accounts that are unquestionably credit hazards; what are you going to do about them?

One of our friends, who is vice-president and treasurer of a large commercial house with branches in every important city, said that in making his rounds to check up his credit men, he was more fearful of the one who had the smallest percentage of outstandings than he was of the other fellow whose percentage of outstandings was considerably higher (volume of business, of course, considered), for he was afraid the man that prided himself on a small amount of loss was too strict and was losing business, whereas the other fellow was losing some extra money but the final analysis showed he was making business by his more liberal methods.

Credits and Merchandise

Losses are never very large and rules relating to this class of work in most companies are most liberal concerning credits and terms. Why? Because of competition. If payments on merchandise are not made as agreed, there is a definite value in the appliance (depending on its condition), upon which you can cash in as satisfaction for your debt, whereas gas used is represented only by a bill.

Nevertheless, the open market makes your policies on selling merchandise line up with those of your competitors. We believe that companies not in agreement with this thought, in making comparisons with others that do have the desired policies, will note the strides made in sales of merchandise and will follow in adopting the liberal policy.

If they are won over to liberal policies on their merchandising, they will next try the same plan on their gas accounts.

Now to get back to your credit hazards. On some of them deposits will be required. Companies who favor guarantees will secure questionable accounts by having them guaranteed.

Guarantees

If you accept guarantors, be liberal with them, for, in the first place, you would not accept them in the capacity in

which they are to act unless they had established good accounts.

Unless some method is devised whereby the guarantor can be notified that the customer he has befriended is not paying his bills with due promptness, the guarantor is perfectly right in the reaction that takes place, when a final bill is presented (if too much time has elapsed) by saying, "Why did you not tell me sooner that this fellow was slipping?"

While the guarantor may pay that bill, you have the assurance of some of the best-informed credit men in your association, that you have lost a friend. To avoid such friction one company does this.

Usually a deposit should be refunded after a year or so, provided the customer has paid his bills promptly. With most companies, when an account is guaranteed a different action takes place. They assume that the guarantor has bound himself for life to the gas company to care for the account, unless the guarantor is careful to keep the transaction in mind and sees that the guarantee is withdrawn.

If the account guaranteed has run along for two years or less, and the bills have been promptly paid in the meantime, automatically the guarantor should be notified that he has been released from his obligation; but with some companies, if five years after the account was opened and guaranteed, should misfortune overtake the customer whose account was so guaranteed, the guarantor is held responsible and he has to pay. Is this an attitude that will tend to establish friendly relations?

We believe that a guarantor is a symbol of generosity, and more he is helping

NOTICE TO GUARANTOR

OFFICE

ELEVENTH AND OLIVE STREETS ST. LOUIS June 30. 1923

(GUARANTOR) Mr James Whitney

ADDRESS 3742 La Clede Av.

OUR April BILL AGAINST Mr William Johnson

4742 Townsend St. AMOUNTING TO $ 12 80

DUE May 15 HAS NOT BEEN PAID. AS CREDIT WAS GIVEN THIS CUSTOMER ON YOUR GUARANTY, WE REQUEST THAT YOU PLEASE ARRANGE FOR EARLY SETTLEMENT OF THE ACCOUNT.

LED. 37 DIST. 4 BY

Form B

Actual Size 4" x 6"

not only a new customer but has also agreed to secure you against loss. Now, if we release our deposit after a year or two, or even by request, why not automatically release your guarantor? Establish a friendly point of contact with him by writing and telling him that he used good judgment; for the account he guaranteed has stood up during the period of development and because of prompt payment by the customer he is released from further obligation.

with accrued interest, should be automatically refunded to him at the most within a two years' period. This is good will and we feel that the customer is always appreciative of courtesies extended, and whenever we talk of relations with customers, we know that it is friendly relations we are thinking of.

Of course the account should be carefully gone over and any question of risk eliminated before refund is made. Some

FORM 232

____________________ COMPANY

CHICAGO

NOTICE OF DEPOSIT REFUND

You have established a good credit record by the prompt payment of your gas bills; therefore, in accordance with the Company's policy we are pleased to refund your deposit.

The inclosed check includes the amount of your deposit and accrued interest at the rate of five per cent (5%) per annum.

PLEASE CASH CHECK PROMPTLY

BY____________________
SUPERINTENDENT OF CREDITS AND COLLECTIONS

Form C

Actual Size 3½" x 8 ½"

Deposits

There appears a tendency in all companies, which is evidenced particularly in those with whom we have discussed the subject, to adopt more liberal policies concerning customers' deposits, and also as to the process of making refund of such deposits.

Some companies still insist on securing accounts by deposits that other companies would readily accept on a credit basis. Not only that, but after taking the deposits, some companies retain them for what we think is an unwarranted period of time.

If a customer has established a record of prompt payment of bills, his deposit,

accounts—particularly new ones of a speculative nature—pool rooms, rooming houses, etc., where frequent transfers of ownership are made, cannot be considered. A typical form, informing the customer of such refund, is submitted. The text is most friendly.

Whenever a deposit is required to secure an account, in justice to the customer, he should be heard if he wishes to question our action. The initial request for a deposit should not be in the form of an arbitrary demand.

Some companies deliberately delay their requests for a deposit for a purpose, particularly when rooming houses and new business accounts are concerned.

For, from the time the meter is turned on to the time when a representative of the Credit Department calls, the gas consumed gives a basis to work on in computing the proper amount of money for a deposit.

It is the belief of many that an account, after having been established and later proved unsatisfactory because of the necessity of shutting off the meter to force payment, or because the collector reports difficulties in securing access to the premises to shut off gas, is a type that should be secured by deposit.

We agree that such an account is an expensive one, but we should not act with haste in demanding a deposit. If a customer, because of stress of circumstances, is unable to pay his bill with promptness, he must either comply with your demands and permit the collector to discontinue his supply of gas, thereby causing his family to suffer, (and suffer they will, for gas today is not a convenience, but a necessity), or he must keep the cut-off man out.

How, then, can such a man, besides paying his bills, pay an additional amount in the way of a deposit? It is very true that through process of law you can recover your meter and take your service from him and make him provide some other means to supplant your service, but you have lost one of your customers, really one of your relatives.

The method of procedure with a customer who has been shut off for non-payment of bills, and the requisites necessary before gas can be again be turned on, is a mooted question. An old Indian proverb says, "And when the halter has slipped do not give chase with sticks, but with grain."

We do believe, if a delinquent customer is able to pay, but because of indifference causes difficulty in effecting collections and bars your collector, he should in some manner be penalized.

The fellow who is undergoing vicissitudes has enough hardships; he has a burden to carry and should be assisted. But one thing is certain, and that is, the delinquent customer has his own relations and you do not know when they may be useful to you. We do agree that if such customer can be interviewed he may get our viewpoint and at least we have not lost anything by coming in close touch with him.

Collections

Under this subject we have considered only overdue monthly bills, that is, current accounts in arrears.

Your Collection Department functions better for your company in collecting money than in cutting off gas for non-payment of bills, or sending delinquent accounts to your shut-off department for cut off.

Before discontinuing gas supply for non-payment of bills, which action follows presentation of your final notice, it is imperative that the customer be interviewed and given every reasonable opportunity to pay his indebtedness and all reasonable efforts made to collect before he is deprived of the convenience of your service. If the collector cannot interview the customer, a letter should be written informing him of your proposed action. The reason for this is that notices are often left in mail boxes and overlooked, or in some way do not get into the hands of the proper person.

When we say reasonable efforts, we think this should be emphasized by say-

ing that all your reasonable efforts have been exhausted, and there is no alternative left but to discontinue the service. As mentioned before, the class of people usually called "dead beats" are not so because of desire, but because really of financial distress.

Collection books should show the rating of the customer when paying his bills.

STREET Emerson Av							LEDGER 130		DISTRICT 5			GROSS AFTER 6/27	
PAGE	FOLIO	STREET NUMBER	NAME	DEPOSIT	RECORD	ADD. CH.	AMOUNT DUE	NOTICE 1ST	NOTICE 2ND	NOTICE FINAL	COLLECTED DATE	COLLECTED AMOUNT	REMARKS
4	12	1st fl 270	John Smith		2/12	40	4 20	6/27			7/6	4 20	Call 7-6
10	3	Ste 320	Roesch Bros.	15	10/12	50	5 70						600476-10
10	4	Rear 320	" "		10/12	52	5 92		6/27	7/3			279584-5
12	8	6 Hall 326	Ramsey & Co		1/12	6	86						Real estate Ofc
12	10	N. Hall 328	"		1/12	24	2 84						4c W. Madison Call R4 11
18	1	R.H. 500	Mrs James Brooks		2/12	126	13 93	6/27					Call July 7

FORM 601 CHICAGO

Form D

Actual Size 5" x 8"

The collector should have all possible information concerning the account. A simple code is recommended by showing the number of bills rendered during the course of the year, and the number of times the customer is late as example, 12-1.

Paradoxical as it may seem, we find in our investigation that very little trouble is encountered with the people of the poorer class. Possibly your greatest difficulty is in effecting collections in your so-called high class residential districts.

One company recently made quite a distinct change in the method of handling the collection of overdue current accounts by eliminating from the collection book, for the first month, all bills of 2,000 cubic feet or less. No notice of any kind was sent; no attempt was made in any way to collect, if there was only one month's delinquency. From a study made of this new procedure, covering a period of four months, we found that 16% of the total number of customers failed to pay their bills in time to obtain the usual discount.

Therefore, this 16% represented 100% of the accounts delinquent.

Out of this 100%, there were 38% one month in arrears, and these bills showed 2,000 cubic feet, or less, consumption. With 38% as a new unit equalling 100% indicating all bills of 2,000 cubic feet or less, 60% were paid before the following month's bills became delinquent. At the

end of three months only 2% remained unpaid, but some of these were made up of very small items, or were protected in some way by security, wherein there was no justification for cutting off.

Supervision

Supervision of all the men employed in credits, collections, and work of all contractual relations should be constant. Supervisors should be selected who are alert and have executive ability. They should be permitted to use discretion and be trained to make proper reports. As training and education has been developed by another sub-committee, we will not dwell on this subject, except to recognize the necessity of its importance in this branch of our work. A valuable point of contact is here if properly used.

We believe that collections should not be farmed out; that is, turned over to some outside agency for collection. This method may bring results in dollars and cents, but will be most harmful to your company's interests. We could deal at length in submitting plans and routines and various schedules that we have observed, but, in the main, principle, not routine, again is dominant. Get your money, expect a certain amount of loss—make it as low as possible, but force every effort to humanize your collection department.

There is nothing new in the foregoing; your old Hindu horse trader knew this in his dealings. There is an old proverb from his land that reads something like this:

Some are sulky while some will plunge,
Some you must gentle, and some you must lunge,
Some—there are losses in every trade—
Some you can't make at all.

Final Bills

These will show the result of your credit work. The amount outstanding at a given time will tell you the true worth of your Credit Department.

On some of these bills you will find your customer's new address shown. Bills of this type will very seldom trouble you, if you are serving the customer at a new location in your territory. Automatically these bills with local forwarding addresses can be carried forward to the new account, and although routines again differ concerning how this should be done, in the main the easiest way is by transferring the amount of the final bill from the old account to the new account, and bill it on the first statement rendered to the customer, indicating the former address for his information. A typical form is submitted.

Some final bills show a forwarding address to customers who have moved to other cities. We look on these with distress, but to a large extent it is magnified, for the greatest number are paid.

The bothersome ones are those that have no forwarding address. And we wonder how much such a bill is worth. Work and patience; then after a certain period has passed, say three to six months, you have, to a large extent, set up before you in plain dollars and cents, a record wherein you can tell how your Credit Department is functioning.

Final bills are collected in innumerable ways. They are overlooked by your customers, not with intention, and are often paid with apologies. They are brought to light, sometimes when a reference letter is received from another gas company, and by numerous methods which usually follow a general plan. We rec-

ommend special high class men for collectors on this kind of work; men who have proper training and a real desire for the work; men who will turn in a report of your missing man, giving careful attention to previous credit information, so that when the report is complete, the bill clear up these bills. If a certain class of your customers know that you have no definite policy in tracing them, you are building up trouble, for the effect is cumulative and you can rest assured such customers will discuss your company as one without much business system.

NAME James B. Hoops
MAIL TO 3842 W. Monroe St

OFFICE HOURS
FROM 8.30 A. M. TO 5 P. M.
SATURDAY 8.30 A. M. TO 1 P. M.

Ledger 9 Page 1 Folio 12 Chicago May 29 1923
For Gas Consumed at 4111 West End Av
From Apr 28 1923 To May 28 1923 Floor 1st

Index at This Reading	600	00
Index at Last Reading	580	00
To Consumption of	20	00

2 40
20
2.20

Previous Bills From

Charge on Bill Due

Ledger Page Folio District

Bookkeeper

GROSS AFTER TEN DAYS FROM DATE OF BILL
PLEASE BRING THIS BILL WHEN PAYING AT OUR OFFICE
FORM 132
FINAL

LEDGER 9 PAGE 1 FOLIO 12
NAME James B. Hoops
GAS USED AT 3842 W. Monroe
DEP. NO. None AMT. DATE
PLEASE SEND THIS STUB WHEN PAYING BY MAIL
YEAR 1923 21 REG. 5/R
THE PEOPLES GAS LIGHT & COKE CO.
CHICAGO

2 40
20
2.20

Previous

FINAL

Form E

Actual Size 5" x 8"

and report can be properly filed and keyed for future use.

We think you will agree that your unpaid final bill file is a port of missing men and that a final bill, which appears to be a total loss at the time it is filed, may be worth its full face value at any time.

So spend a little time and money to properly care for these bills and the collectors' reports, and you will be repaid.

All companies will agree that the cost per item of collecting a final bill is out of proportion to what it should be, but there is a distinct purpose in endeavoring to

Contractual Relations

The obligations of all utilities regarding service to the customer were established by common-law, as follows: The utility

(1) must render adequate service.
(2) must serve all.
(3) must serve without discrimination between users.
(4) must serve at a fair price.

These obligations were originally enforced through the courts. Today, in most states, the chief agency for their enforcement is through the State Utilities Commission.

The first two sections are the chief concern of your committee. We feel that our industry not only fulfills the requirements lawfully, but we want to do more. What, then, is our difficulty? Possibly Josh Billings knew, for he once said that the trouble with a lot of people is that they know so many things which "aint."

When we think of all the adverse influences that have been brought to bear against us by demagogues, and which have largely been absorbed by some of our customers, we are sure that all of our fraternity must be on guard to eliminate these false impressions, and to show our customers that we mean what we say concerning our fair dealings with them.

We must be patient, and see that all associates and all members of our industry get in the same mood; particularly not only while with the company, but while with their associates, in their homes, in their civic life and wherever their identity might be connected with their employment, so that they will reflect the thought of one of the greatest men in our industry who has said that considerable may be accomplished, considerable benefit given, and considerable obtained, by showing a readiness to serve in unexpected ways.

First impressions, if they are pleasing, have a lasting value whether it is in the effect of your office, the appearance of your representatives, or the courtesy, tact, and efficiency evidenced. All of these should be carefully watched and improved. Also the training of employees is of the utmost importance. The story concerning this is so long, and the effect so prominent, that we again refer to the scope of this work which has been developed by another sub-committee.

The main difficulty in our contractual relations is that the customer rarely tells of his disapprobation. Of course, we hear a few unpleasant things—but what of the whispers—the majority who nurse their grievances and do not let you hear from them directly.

It looks as though they seem to think that our house is haunted. Haunted with the ghosts of by-gone days, by-gone regimes and arbitrary managements; and the peculiarity of all ghost stories is that they are never told first-hand.

Records

All records in transacting business with our customers should be available. Now when we say they should be available, it is impossible for us to state where their position should be in your office.

Because of lack of space in the business sections of large cities, they must necessarily be in one position, and possibly quite remote from the order table, or the order counter. With smaller companies, that may have the good fortune to be differently located, such records will be immediately at hand.

It does not matter where located, by some process of communication that can only be developed by the company interested, they can be made available by a tube system, a telautograph system, or telephones.

Records such as uncollected final bills, delinquent accounts of any description, may help you to collect some unpaid bills; old ledgers may enable you to confirm some disputed point with a customer, but do not make the mistake of keeping them too long, when they are to be kept only to support some proof that is adverse to your customer's contention.

Why stir up contention over some old account and have your customer inimical to your company when it would be better to utilize the money spent in keeping these records to gain good will and accept the customer's word as final. For often it is evidently given in good faith, though, of course, he is going on memory only. Write off the amount involved, for you will find if you keep tab it will be a very small total.

In the main, whether in a large company or small company, the first floor should be so arranged that all business the customer may transact can be disposed of in this centralized space. Unfortunately, some companies may not be able to accomplish this because of the volume of space needed, but the next best thing must be figured out, and the requirements needed you will find, after study, can be arranged for.

Another thought your committee would like to make impressive in this report is to eliminate, as far as possible, the word "rules." Instead, refer to your agreements, terms of service, or any other name that will not have the harsh sound that this word "rules" has, for when considering the word, customers think of some penalty to be invoked. This causes resentment. "Rules" may be at times necessary in legal phraseology, but they serve no purpose in our every-day conversation with our customers, or on our printed forms.

Telephone

Your committee, throughout its report, has emphasized points of contact. The telephone is one of the most important.

Relaying or shunting of messages should be eliminated as far as possible. This is again a problem each company must work out for itself.

Your people who come into contact with your customers through this medium should be selected with the greatest of care. Women are admirable for this work in many cases, but in the main, we think men will prove the more efficient and give the best results.

Listen in on your telephone order tables and you will observe in most cases a very dominant element, and that is haste.

Your telephone connection—why the hurrying? We suppose there is no other medium of communication in the world equal to it; that is, where haste is so universally evidenced. Yet there is no other medium where people can get their request or order put over in quicker and shorter time.

Consider any other branch of your business, or, for that matter, any other business; large mercantile houses that pride themselves on their service to their customers. The customer, after a trip of from four to ten miles, waits and waits patiently for attention, only a few indicating hurry; but what a different result we get when the customer orders or calls by telephone, even if he has to wait only for a slight fraction of a minute. He exhibits a noticeable degree of impatience, a sputtering hurry. Keep your lines clear and see that they are adequate to meet all demands.

Your clerks at the order table should be made to understand these things and not allow themselves to be worked up to the same state of mind that the customer is. They should placate and conciliate the impatient, hurried customer.

Letters

With possibly the exception of high bill complaints, in no other department in our

point of contact with our customers does correspondence mean so much. Considerable use is made of form letters, and if these are arranged and phrased so that the customer is readily acquainted with some detail concerning work that he has given us, they serve a very useful purpose.

Dear Sir:

Permit me to thank you for the account recently opened with our company.

We appreciate your business and shall be glad to hear from you concerning the service you receive, as it is our desire and intention to satisfy our customers in every possible way.

Yours truly,

Supt. Commercial Department.

Form F-1

Dear Sir:

We thank you for your order and trust that you are entirely satisfied with the installation.

We appreciate your business and shall be glad to hear from you concerning the service you receive, as it is our desire and intention to satisfy our customers in every possible way.

Yours very truly,

Supt. Commercial Department.

Form F-2

It takes less time to develop a reply by a form letter than by dictation, and if the effort is voluntary on your part—that is, you are not waiting for the customer to make a request, but giving him advance information—such type of letter is an ideal means of communication.

Some companies make good use of notices which are left by their representatives, others use postal cards.

Form 663

Date............192....

We are anxious to have you pleased with our service, therefore, our representative who called to demonstrate the proper method of operating the gas range has been asked to hand you this postal card for your convenience in telling us whether or not instructions given were satisfactory.

....

....

....

Name ....

Address ....

Demonstrator ....

Form G-1—Actual Size 5½" x 3¼"

Form 663

Date............192....

We are anxious to have you pleased with our service, therefore, our representative who cleaned and adjusted your "gas appliance burners" has been asked to give you this postal card for your convenience in telling us whether the work was done to your complete satisfaction.

....

....

....

Name ....

Address ....

Fitter ....

Form G-2—Actual Size 5½" x 3¼"

Be careful of the indiscriminate use of postal cards. A survey of forms showed a postal card acquainting the guarantor that his guarantee, covering the account of a customer, giving the customer's name and address, was accepted. Good will! Yes, but at least, exceptionally bad form, with a bad reaction if the customer saw it.

Where a customer has taken the initiative, it is very difficult to formulate any type of form letter that can be construed

as a definite reply. Dictated letters are advised.

Your correspondence, on the whole, should have the best of support in the way of correspondents and their assistants or clerks, and whether dictation is by machine or through the medium of a stenographer, the best are none too good.

There should be no gaps between receipt of your letters and your replies thereto. Ample facility should be at hand to get all the facts required.

A follow-up of some kind should be maintained on letters that convey a promise. Do not turn the order over to the executing department and assume it is finished. You have made the promise personally and it is your business to make good.

Your replies should be correct and all details free from fault. Do not assume that your correspondents and their clerks are always efficient, for there is invariably a time when they, themselves, are not free from fault, and this irritation is always reflected in their letters.

Some one in authority should see your incoming and outgoing mail at varying periods.

Letters should never be signed until the spelling of the name has been checked, for the name is a "touchy" point. Our names are considered an important part of our individuality. We resent—and rightly—any liberties taken in the way of misspelling or abbreviating.

Addresses should be checked, for if they are not correct it will only delay and complicate matters.

Express your thoughts clearly, choosing carefully the ordinary words as far as possible. Make your sentences short, and, above all, use good stationery.

Signatures to all letters should be complete. That is, officers and officials should show their titles after their names. Subdepartment heads should show their department in the same fashion.

It might, perhaps, be well to try to organize a definite policy concerning signatures. Like our names, they are individual and characteristic. Frequently, the writing is illegible. The suggestion is made that the signature be repeated in type just below it.

Notices

All notices presented to the customers should be simple and dignified, and those that contain any contracts or agreements should be couched in the most simple terms.

Any forms that contain reports from operating sections, conversely should be most definite and complete, for it is from these that we are ready to give the customers precise and definite information.

There are other forms of notices that might be termed advice, which might be given particularly to customers of companies who encounter peak periods during moving or frost seasons. Some companies endeavor, at quite an advanced date, to call the attention of their customers to such seasons by advertisements and notices on the gas bills. Some even go so far as to prepare attractive booklets that the customers will read.

Information to Customers

In our endeavor to give our customers prompt service, we often find that while we are ready, they are not. The follow-up on this class of work should be very comprehensive. If the information concerning the reason for non-compliance of their request is given them by telephone or letter, before they can complain, you

have a distinct advantage. Why? Because you have eliminated a complaint.

Financing

A very vital point, one of utmost importance to our industry, is that of financing the obligations that we shall have to meet at a very near date, in the extensions that have been contemplated and the improvements that we should like to see installed.

than any other power. Why? Because your welfare is also theirs.

We are reminded of a story told by a vice-president of one of our large railroads, who said that near a certain point, where two of his division lines crossed, was quite a prosperous residential community. In it was an elderly spinster who continually complained about the noise made by signals of locomotive bells and whistles.

"WHY NOT"

CLASS OF WORK 324 ORDER NUMBER 243184 DATE 6-20 1923

ADDRESS 122 So. Michigan Av.

ORDER WAS NOT COMPLETED FOR REASON INDICATED BY **X**

NOT AT HOME		NO ONE TO LOCATE APPLIANCE		JOBBING CONTRACT REQUIRED **INDICATE** REASON UNDER REMARKS	
NOT MOVED IN		APPLIANCE NOT CONNECTED		LEAK IN HOUSE PIPES	
NOT PERMITTED TO WORK **INDICATE** REASON UNDER REMARKS		NO STREET SERVICE		LEAK IN FIXTURES	
NOT READY – WILL NOTIFY **INDICATE** REASON UNDER REMARKS		BUILDING SERVICE NOT CONNECTED		NO FLUE PIPE ON WATER HEATER	
WRONG ADDRESS		BUILDING NOT COMPLETE		UNDESIRABLE LOCATION FOR METER **INDICATE** REASON UNDER REMARKS	
FUTURE DATE BY REQUEST		HOUSE PIPING NOT O. K. **INDICATE** REASON UNDER REMARKS	X	DOESN'T WANT **INDICATE** REASON UNDER REMARKS	
NO ONE TO SIGN CONTRACT		EXCESS PIPING REQUIRED **INDICATE** SIZE AND NUMBER OF FEET UNDER REMARKS		BUILDING MATERIAL IN WAY	
WILL NOT SIGN CONTRACT				GIVE TO INSPECTOR	

REMARKS Referred to inspector

FORM 474 CHICAGO SIGNATURE J. Taylor

Form H-1

Actual Size 3" x 5"

A suggested ideal way to get this money is through the sale of junior securities to your customers. If your company policy, in its public relations with its customers, is such that you have cultivated the friendship of the citizens in your community, and they are assured that you are active in looking after their interests and they believe in your integrity, they will buy your securities, and they will have an interest in your company and its interests that will be more dominant in your company's welfare

She finally brought her case to our friend, and after listening to her tirade very patiently he said that he would be able to correct the noise she was subjected to, if she would follow his directions. This she agreed to do; all the while, though, very impatient to learn what his advice would be, or what action he would take. To her surprise, he suggested that she go to her broker and buy a couple of shares of stock in his railroad, he agreeing to purchase them from her at any time she wished to dispose of

WHY-NOTS

ORDER WAS NOT COMPLETED FOR REASON INDICATED BY X	CALL NUMBER 1	2	3	4	5
NOT AT HOME					
NOT MOVED IN					
NOT PERMITTED TO WORK **INDICATE** REASON UNDER REMARKS					
NOT READY—WILL NOTIFY **INDICATE** REASON UNDER REMARKS					
WRONG ADDRESS					
FUTURE DATE BY REQUEST **INDICATE** DATE UNDER REMARKS					
NO ONE TO SIGN CONTRACT **INDICATE** REASON UNDER REMARKS					
WILL NOT SIGN CONTRACT **INDICATE** REASON UNDER REMARKS		X			
APPLIANCE NOT CONNECTED **INDICATE** UNDER REMARKS WHAT WAS DONE					
STREET SERVICE NOT IN					
BUILDING SERVICE NOT CONNECTED **EXPLAIN** UNDER REMARKS					
BUILDING NOT READY FOR GAS					
HOUSE PIPING NOT O. K. **INDICATE** REASON UNDER REMARKS	X				
JOBBING CONTRACT REQUIRED **INDICATE** NATURE AND ESTIMATED COST UNDER REMARKS					
LEAK IN HOUSE PIPES OR FIXTURES					
NO FLUE PIPE ON WATER HEATER					
UNDESIRABLE LOCATION FOR METER **INDICATE** REASON UNDER REMARKS					
DOESN'T WANT METER **INDICATE** REASON UNDER REMARKS					

REMARKS ON WHY-NOTS INDICATED BY **X**

CALL NO. 1 Risers will have to be separated before meter can be set. Give to inspector.

6/20/23 J. Taylor

DATE SIGNATURE

CALL NO. 2 Customer refuses to sign jobbing contract

6/21/23 S. Smith

DATE SIGNATURE

CALL NO. 3

DATE SIGNATURE

CALL NO. 4

DATE SIGNATURE

CALL NO. 5

DATE SIGNATURE

REMARKS BY WHY-NOT CLERK IN APPLICATION DEPARTMENT

FITTERS ARE NOT TO WRITE IN SPACE BELOW THIS LINE

NO. 1 Phoned customer. Will have done by plumber

NO. 2 Will notify. T. J. L. 6/22/23

NO. 3

NO. 4

NO. 5

FORM 470-4

Form H-2
Actual Size 5" x 8"

them within the following year at the price she originally paid for them.

About a month later, she called on him again and said, "I think I have made a good purchase in buying your stock, and further, your engines do not annoy me any more. I used to lay awake at night, inviting sleep in every possible fashion, without success, but since I bought my stock, each noise that is made by your engines indicates an activity in your industry that is reflected in the returns I get in the money made by your company."

We all know if we can sell our customers our securities, particularly our junior ones, we will have a backing that is almost inconceivable in its strength. Just consider how eagerly bond houses will bid for your bonds if your junior securities are of strength. But you cannot get this condition if you have not established proper contractual relations with your customers. So, besides all the other reasons given to obtain this power; we urge that you consider the benefits of the principles we have presented to you.

Points of Contact

In all our points of contact in our credit, collection and contractual policies, our first endeavor should be to place our customer at ease. Have principles that will be elastic, and see that every customer has proper provision for his needs.

In the past, we know that rules and regulations were rigidly followed, and if a prospective customer did not like them, why he did not have to become a customer.

That was the time when the balance had tipped so that the customer was left high in the air and we were safely grounded. Of course, something happened, and gradually, during the past years, an attempt was made to stabilize this balance between the customer and the company.

At times, because of lack of knowledge of new regulatory bodies, the weights were so placed on the customer's side that the companies were in the air, but gradually the proper balance is becoming more noticeable.

The customer has a distinct idea of his rights, and an appreciable insight as to ours. Cultivate this instinct in the customer. Our customers are becoming more tolerant, and we have become humanized with red blood and take great interest in giving service to our customers by doing anything, and everything, that business methods permit us to do.

The changed condition we all welcome, but in some cases you will find this interest is liable to take the wrong curve, and that ordinary business methods may be sacrificed in order to coddle our customers and do nothing whatever that will inconvenience them, even at the sacrifice of fundamental business principles. Injustice will come to the interests of such companies, as well as to the majority of their customers, for we have all observed that it is not the majority that will take all, but a minority that want everything. So, let us be generous, kind, and considerate, but not foolish.

"The wisest thing we suppose
That a man can do for his land,
Is the work that lies under his nose
With the tools that lie under his hand."

CO-ORDINATION OF ORDER TAKING AND ORDER EXECUTING DEPARTMENTS

O. F. Potter, *Chairman,* Newark, New Jersey.

In making up this report the Committee realized the great responsibility and important part which the department, or departments, concerned in order taking and order executing take in giving the customer his first impression of doing business with the gas company. To him the individual and the department with which he is dealing represent the company, and frequently these are the only parts of the company with which he comes in real intimate contact.

It will be noted that while recommendations may be made concerning departmental lines, it is to be borne in mind that local conditions should always be permitted to modify the application of the presented plan. The first thought in the mind of the committee is to outline the work with a view to making the physical conditions of an ideal office, in so far as the lay-out is concerned, as accessible as possible from the customer's standpoint. He should be cared for with the least possible red tape and with such prompt and courteous attention that there will be no doubt in his mind as to the quality of service the company desires to give.

The creation of the proper contact should be the direction of the utilities' endeavor. Office lay-outs, dispatching, and the physical performance of the order are essential adjuncts to service, for they have a direct bearing on the satisfaction of the customer. Service in its broader sense, with confidence as its ultimate goal, means establishing the most important factor in the utility's relations with its customer—the personal element.

The impossibility of direct contact with the customer by the management of today because of the growth of our business necessitates the delegation to the rank and file of many duties pertaining to customer relations. This results in the employee becoming the main point of contact with the customer. To him the employee is the company, and from the employee's attitude and conduct the customer receives his impressions, draws his conclusions, and forms his opinions of the company. It is in this contact that the extent of confidence and good-will for the company is determined by the degree of human personal interest exhibited by the employee in the customer's order or complaint, and in the sympathetic understanding of the customers' needs, which can only be developed in fullest measure through a *real* desire to serve.

In order to conform to the nomenclature of the Committee and to make definite references to the divisions or departmental lines, we shall take up the Order Taking Department first.

Order Taking Department

Accessibility to the personnel of this department is the first consideration.

The ground floor is the logical location. The lay-out of such a department should consist of a counter, preferably straight, and along one side of the office, but so situated that the customer can see it when entering the office. Signs should be displayed over the counter as an aid to the customer in locating it. The counter should be placed so as to allow sufficient room behind it for clerks both at the counter and at desks, with telephones, so placed that the clerks can at all times face the customer. Filing spaces should be provided under the counter. The desks and files should be systematically arranged in order that a good appearance may be made and also to avoid any impression of confusion on customer's part.

The typing of orders should be done at sufficient distance from the counter and behind a screen so that the noise will not bother the customer. Where possible, it is recommended that the typewriting of orders be done in a room accessible to the counter but apart from it.

Ample telephones should be maintained, so installed in the ratio of one instrument to two clerks. The telephones should be equipped with buzzers rather than bells.

For the convenience of the customer in larger situations or, in fact, any situation, rest chairs, or settees, should be placed in front of the counter, but not so as to interfere with the passage of customers to and from the counter.

A row of desks with chairs should be placed convenient to the counter, either directly behind or in a space adjoining the counter, to which customers with special cases or aggravated grievances may be referred and dealt with by the department head or some one specifically assigned to care for such cases.

The layout should be so arranged that the counter man has everything at hand for the performance of his functions, to take care of the customer and give him service. The reference files or files with a supply of blanks should be within easy reach without taking him away from the counter and the customer.

In a small office the order counter will function properly with other work of the office—high bills, duplicate bills, merchandise, and general information. In a large office, order service work should be segregated from billing and merchandising. It is not considered good policy to so divide the work that it will be necessary to refer the customer from one clerk to another at the counter for various features of the order counter work, it being recommended as extremely desirable to have the personnel generalize in their work so that one clerk could take care of his customer completely rather than to refer him to many special clerks.

In large offices a telephone switchboard for use by the Order Taking Department has been found very satisfactory. A switchboard installed for this use will serve to eliminate delays in placing calls in the hands of the proper employees. Supervision of this board should be constant, and it is essential that the operators be chosen for their tact and intelligence as well as for their innate courtesy and willingness to oblige.

Reports should be kept by the manager of the Order Taking Department showing the number of complaints received of defective appliances, leaks or poor service in general. These reports should be carefully studied in order that the information thus obtained may locate the responsibility and this analysis, if properly taken advantage of, will result in improving the company's service.

At this point it may be well to point out the importance of using tact in declining to do work at the request of the customer. This phase of our business requires delicate handling and a decision from the manager of the department should be secured, in order that the enforcement of certain rules may not cost more in good-will than the expenses involved in doing the work requested.

the premises, for which the customer requests service, has no meter installed at the time he applies for service. Form "B" is used when the premises for which the prospective customer desires service is already supplied with a meter which is not turned on.

Consideration may be given to the elimination of the contract on all transfers.

(74)—1853—5-23 GAS—SET Application Dept.—ORIGINAL

LOCATION 877 W. Maple St County

Near or P. O. Address Orange St Occupied as Res

To (herein referred to as the Company)

THE UNDERSIGNED Mr John Doe

referred to as the Customer, hereby applies for the supply of gas service at the above named location, for an installation

of Range + water Heater Demand cu. ft. ✓ in continuation of

service at 1576 Clifton Ave St. (R. 976 F. 213)

and agrees to use such service in accordance with the terms and conditions of the Company, and to pay at the Company's office the published prices for such gas service, as per Schedule D which will be furnished on application.

Issued 6/25. 1923 Signature {SEAL}

Salesman By

Set Meter	Service Installed ~~YES~~—NO	Piping—New ~~Old—Addit.~~	Piping Completed YES—~~NO~~	Contractor Quick Service Co
✓				

Order Taken for	✓	Order in Shop for	✓	City Cert. No. 8677

Route	Folio	Bills Payable	Monthly ~~Weekly~~	Cr. Dept. O. K.	Deposit	Rec'd by
1016	770			[illegible]	$	

Used Service—Gas—Elec. Before—YES—NO R. F.

Form A

Issued in triplicate. The duplicate and triplicate are work tickets for fitter's report. Reverse of original provides for fitter's report and reverse of duplicate and triplicate space for recording fitter's time.

Meter Application Department

The Meter Application Department, as its name implies, takes care of all work (except complaints) in connection with the service through the meters. The customer applies at the counter in this department for service, or seeks transfer of service from one address to another and signs the necessary contract.

The following is the routine of a typical procedure. Form "A" is signed when

As soon as the contract is signed and before the customer leaves the counter, reference is made to a card file of meters, showing locations, to designate the status of the order; whether set, turn on, or main extension. Also, the status of the customer's credit is obtained from the Credit Department, where a card file of customers is maintained. If from credit records and credit information thus noted on the application for gas, it appears advisable to secure a deposit, re-

quest is made and the amount required is collected by the counter man who gives the customer a receipt. If there is any delinquent amount on the books, or other question of credit, the customer is directed to the Credit Department where he is interviewed by an employee specializing in that line of work.

(497) M. P. **GAS ACTIVE** Application Dept.

LOCATION County

Near or P. O. Address Occupied as

To (Herein referred to as the Company)

THE UNDERSIGNED effective from
referred to as the Customer, hereby applies for the supply of gas service at the above named location, for an installation

of Demand cu. ft. in continuation of

service at St. (R. F.)

and agrees to use such service in accordance with the terms and conditions of the Company, and to pay at the Company's office the published prices for such gas service, as per Schedule which will be furnished on application.

Issued 192 Signature {SEAL}

Salesman By

MAKE ACTIVE	#	CHANGE NAME FROM			From Last Meter Reading For Record Only Read Meter
Route	Folio	Bills Payable { Monthly / Weekly	Cr. Dept. O. K.	Deposits $	Rec'd by
Used Service—Gas—Elec. Before—YES—NO					R— F—
Order Taken for		Order in Shop for			City Cert. No.

Form B

Reverse shows inspector's report and credit information.

If upon application by the prospective customer it is found that there is no service connection to the house from the main, Form "C" is filled out and signed by the customer. This form is made out in triplicate and serves as a bill and coupon, the stub being the coupon which the cashier detaches when the charge for the gas service is paid.

It is recommended that meters be shut off and not removed where vacancy of apartment or house is deemed temporary, and in instances where an application is received for gas service to be supplied to premises where the meter is turned off this should be handled by men operating out of the Commercial Office. The thought behind this is that the service is more readily available for the customer if the meter is not removed.

In the event of a request for service coming by telephone the order should be accepted without paying any attention to the matter of signing a contract or question of credit. After service has been

given, an application or contract should be mailed to the customer with the request for signature. In case it is not returned promptly, it should be followed up by an outside man.

Upon the return of the application, the credit information is scanned and the applicant's name checked against the credit record. Deposits are not to be required of all customers, this requirement being dependent upon the customer's position in the business world, and personal references, or the previous record, if any, of the customer with the company. It is assumed that the customer having once enjoyed the privilege of using gas, will very seldom, in case the application warrants a deposit, refuse to pay it and thereby lose the service. Experience has shown that only in a very few instances is it necessary to deprive customers of service on account of refusal to pay deposits. When it is decided to obtain a deposit, the customer is notified by a representative of the company who is authorized to collect the deposit and to give the customer a temporary receipt. This temporary receipt is good for three days only, and must be presented at the office by the customer within that time, either in person or by mail, at which time a permanent receipt is given, see Form "D."

(571) 1953-5-23 **GAS SERVICE ORDER** M. & S. Extension Dept. Original for Com'l Dept.

Name

Location

To

Please install gas service pipe for above premises, in accordance with your rules, for which I/WE agree to pay herewith as follows:—For New Gas Service connection from street main—sidewalk main—curb service—to building—curb and for feet over 40 @ $

For Improved Pavement and/or Sidewalk Charge $

Change Position of Service $

In consideration of the Company maintaining Service, the Company retains title.

County Road

Private Street

Remarks:

See Order for

Dated, 19 Signed

Witness By

Commercial Dept.

Accounting Dept.

GAS SERVICE ORDER

Date of Order 19

Name

Location

For Gas Service Connection

For Improved Pavement and/or Sidewalk Charge

Received $ Date

Credit Acct. 990-1 TELLER

Remarks:

Payment Posted By Date

Form C

Issued in triplicate. Reverse of original and duplicate blank. Triplicate shows shop foreman's report.

When a customer desires to have his supply of gas discontinued, he may call personally at the office or telephone. In either case, a form such as "E" would be used, indicating that the customer's meter is to be removed, or form "F" indicating that the service to that particular customer is to be discontinued at the address given and the index of the meter taken. This latter form provides reference space as to the future disposition of the meter at the given location. Each of these forms is made out in triplicate; the triplicate remains at the Application Department as a follow-up, and the original and

Consumer's Deposit
Date of Deposit .... 19 ....
Name ....

Address ....

CASHIER'S COUPON

Amount of Deposit		
Consumer's Ledger and Folio		

This Receipt Must be presented when Settlement is desired.

No. .... District Application No. 349023

.... 19 ....

Received from .... the sum of .... Dollars, as security for the payment of all bills due for service in .... name, which sum with interest thereon, at the rate of four per cent per annum, is to be repaid in final settlement: the bills meanwhile to be paid regularly as rendered. No interest paid for a shorter term than three months, and interest to cease when the use of Gas is discontinued.

Not Negotiable. For the Company,

$ ....

Received from Gas Company,

the sum of .... $\frac{}{100}$ dollars

in full for the within deposit and interest thereon to

.... 19 ....

Date refunded .... 19 ....

Signature ....

Folio .... Line ....
Date discontinued ....
Final Index ....

Gas Regular Service OK by		
" P. P. Service ...... OK by		
" Sundry Sales ...... OK by		
" Suspense .... OK by		
Electric Service .... OK by		
" Sundry Sales OK by		
" Suspense .... OK by		
TOTAL		

Refunded by ....

Form D

72—671—12-22 REMOVE METER Application Dept.

LOCATION

CUSTOMER — DATE TO COMPLETE

TERMINATION NOTICE OF GAS AND ELECTRIC SERVICE FOR ABOVE LOCATION — INFORMATION BY LETTER-PHONE-PERSONAL

TO

OTHER A/C CONTINUE A/C TO HAS REMOVED TO } GAS ELEC. — ROUTE — FOLIO

SEND BILL TO — KEY AT

DATE ISSUED 192 BY — SIGNED

ROUTE — FOLIO — BY

REASON FOR REMOVAL

REPORT OF METER REMOVED

SIZE	MAKE	COMPANY'S NO.	INDEX

DATE

TIME

GAS HOW FOUND

WORKMAN

Form E

Issued in triplicate. Reverse of all three show material used and space for reports.

duplicate go to the shop. When the work is performed the original is returned to the Application Department where it is checked against the triplicate and is then forwarded to the Accounting Department with the necessary information filled in, including index, so as to be taken up on the customer's ledger. The duplicate is retained by the shop for its files.

home, a card would be left, reading as follows:

...............Gas Company
Date......192... ......M.

Our fitter called today in answer to your request to have .... but failed to gain admittance.

Please advise nearest ....Gas Co. office when it will be convenient for you to have us call again.

LOCATION					
CUSTOMER				DATE TO COMPLETE	
TERMINATION NOTICE OF GAS AND ELECTRIC SERVICE FOR ABOVE LOCATION To				INFORMATION BY LETTER-PHONE-PERSONAL	
OTHER A/C CONTINUE A/C TO HAS REMOVED TO } GAS ELEC.				LED.	FOLIO
SEND BILL TO			KEY AT		
WILL BE PREMISES HAVE BEEN OCCUPIED BY				ON	192
INSTALLATION			METER NO G		METER NO. E
INDICATE BY √ IN BLOCK REASON FOR TERMINATION	REMOVAL	OUT OF BUSINESS	TERM. OF CONT.	NON-PAYMENT	TEMP. SUSP.
DATE ISSUED 192 BY		SIGNED			
SCHEDULE A. B. Q. S. 6s ROUTE FOLIO		BY			
REMARKS					
METER	CUST	SCH.	INST. c/o	CODE	
24 MULTI APPLICATION DEPT.					

Form F

Reverse shows various information, meter index and reports.

The Meter Application Department receives each day from the Gas Shop, a report of the status of orders dispatched to them so that, in case of inquiry by the applicant for service, the Meter Application Department is in a position to give the information without causing delay by telephoning the shop. If a representative of the Shop Department calls at the customer's premises and is unable to gain access on account of no one being at

Inquiry and Complaint Department

The Inquiry and Complaint Department should be the clearing house for the customer for all trouble and complaints in his relations with the company. Complaints of every nature are received here. Any question of billing and allowance is handled by this department. Whenever possible the case is adjusted and disposed of by the employee receiving the customer and while the customer is present.

Or, if the case calls for investigation, it is turned over to a specially trained outside man. As already referred to, a telephone table board is maintained in this department where all telephone complaints and inquiry calls are handled.

New Business or Merchandise Department

It is desirable for purposes of accessibility and show room space, to display appliances in a manner and in a location where they will be readily accessible and can be seen by the customer entering the office of the gas company. The order counter can indicate by signs that orders will be received at that point for appliances or for their installation.

A good form of sales ticket should be used. A typical one, as per form "G," is made up in triplicate. The three copies are identical with the exception that the

MERCHANDISE DEPT

1373- 4 ROUTE | DATE ORDER TAKEN | ACC'T NO.

FOLIO | NEW OLD NON. C. | Date Reported for Billing

CHARGE ACCOUNT OF

CHARGE TO ADDRESS

DELIVER NAME

DELIVER OR WORK ADDRESS | AM'T REC'D

NEAR

SEE ORDER FOR- | SERVICE INSTALLED YES NO

Amount of Sale | Rec'd on Acc't | On Next Bill | METER INSTALLED YES NO

BI-WEEKLY MONTHLY PAYMENTS $ | CASH CHARGE LEASE | C. O. D. $

SALES DEPT | SALES PERSON

ORIGINAL

INSTALLATION

Qty.	Watts, C F T, A F.	ARTICLE	Repl.		

1373- 4

CREDIT O. K

CASHIER'S STAMP | Total

SUBJECT TO CONDITIONS ON REVERSE SIDE

SIGNATURE

BY

ROUTE | FOLIO | A/C No | DATE

CREDIT ACCOUNT OF

CREDIT TO ADDRESS

DELIVER TO

NEAR

NEW—OLD

NON C.

BI-WEEKLY

MONTHLY

CASH CHARGE LEASE C. O. D. $

1373- 4 | CASHIER'S STUB | SOLD BY

AMOUNT RECEIVED ON A/C $ ______ BY ______ | AMOUNT OF SALE $ ______

AGREEMENT

The title to property so sold on the deferred payment plan shall remain in the Company until full purchase price is paid

Monthly payments on account of the purchase price shall be due and payable with current monthly gas or electric bill rendered to the purchaser

Should the purchaser fail to make any monthly payment or cease to be a gas or electric consumer of the Company, all the remaining installments shall, at the option of the Company, immediately become due and payable

In default of payment of purchase price, or any installment, the Company may reclaim and take possession of the property wherever the same may be found

If more than ______ feet of pipe is required for installation of ______ on ______ floor, a charge of $______ per foot will be made for each additional foot of pipe The usual charge of $______ per floor will be made for connections above first floor

Order Rec'd ______ Ret'd from Credit Dep't ______

Sent to Credit Dep't ______ Fw'd to Shop ______

CREDIT DATA

Rec'd Credit Department ______

Account Opened ______ Deposit ______

Mdse Purchased	Average Bills	Bal on Acc't

Form G

Issued in triplicate. Original "pink," duplicate "white," triplicate "yellow."

original has a coupon which is called the Cashier's Stub, a similar coupon on the duplicate is the Customer's Receipt, and on the triplicate this coupon is called the Auditor's Stub. This form is made out for all work from sale and delivery, to installation, and accounting and billing, and is worked from this originating form. All sales made by outside salesmen are subject to approval by the credit department. However, for sales made in the office, the credit rating is obtained before the sale is closed and before the customer leaves the office.

The credit approval is obtained by using a National Cash Register Credit Machine. This machine works in conjunction with a telephone. The forms are inserted in the machine and the name and address telephoned to the Credit Department. Here the credit is looked up in a card file and if approved the clerk in the Credit Department punches a key on the credit record machine which marks an "O.K." on the form in the machine on the sales floor. If credit is not approved, word is relayed to the salesman by telephone and the customer is then referred to the Credit Department where the question is gone into in detail.

The name on these forms is printed in pencil for legibility; and all other information is written in long hand. The form in its entirety is sent to the cashier by pneumatic tube, or messenger, where the stubs are detached and stamped and the cashier's and auditor's stubs retained. The balance of the forms are returned to the sales floor where customer's stub is given to the customer as a receipt. The original is then sent to the Bookkeeping Department and the white and yellow copies for non-installation appliances sent to the Delivery Department and for an installation appliance, to the Distribution Department. The cashier's stub is used for balancing the daily cash and is held in that department. The auditor's stub is used for auditing purposes in checking the legitimate use of each order, reconciliation of cash and sundry sales charges, etc.

Order Executing Department

In the Delivery and Distribution Departments the stubs of Form "G" are used as follows:

For purposes of delivery the white copy is sent out with the driver and the yellow copy held in the office against him. When delivery has been effected the white copy is returned to the office and in the Delivery Department, the yellow copy is then sent to the Merchandise Department to be checked against its follow-up on the original, after which the latter copy is released to the Bookkeeping Department for proper entry and billing. In the Distribution Department, after delivery has been made and white copy returned, it is turned over to the Fitting Department for installation of the appliance. When installation has been completed and the white copy again returned to the office, the yellow copy is sent through the channels as described above. The customer's contract is printed on the back of Form "G," for which the customer signs on the face under the statement "Subject to conditions on reverse side." No signature from the customer is taken for delivery of appliance. It is estimated that seven days elapse between date of sale and the delivery, installation, inspection and rendering of bill.

Upon receipt of sales form in the Delivery or Distribution Department (Order Executing Department) it is necessary in order to obtain the appliance from stock and make delivery, to make from

the sales order, a stockroom order as per Form "H." Each stockroom order must bear a sales form number.

Delivery of installation appliances by the Distribution Department is made by an employee who is a fitter and who makes a survey of the installation job to determine the amount of material required for the work. About six sets of fittings have been standardized to cover the various kinds of installation jobs. These fittings are put up in bags and one is left at each job; the set most suitable for the work being determined by the survey of the fitter-driver. With each sales form upon which delivery is made, the driver turns in a form (Form "I") showing the material delivered. This form is then given to the fitter making the installation and by whom the amount of material used is inserted. Each installation job is inspected by a fitter-supervisor and at that time a pick-up of the unused material is made. The supervisor then fills in on the form the material collected. This information is carefully checked, priced, and prices extended, which enables the Distribution Department to keep in touch not only with the economical use of the material but also to learn whether each job is within the contract price for doing the work.

The appliance men cover the territory on foot and do not have helpers. As already mentioned, each installation job is inspected by a supervisor before the sales form is returned to the Comercial Office and billing rendered to the customer. The appliance man does not come to the shop but is seen twice a day by the supervisor who takes his work to him. The complaint men, on foot, take care of all appliance trouble and adjustments. When visiting the premises of a consumer for the adjustment of an appliance for which a complaint has been specifically made,

387 MUL FI. OPERATING STORES

________ STOREROOM STORE ORDER No. ________

DATE ________ 19___ ORDER No. ________ DEPT. ________

FURNISH FOLLOWING ARTICLES TO (NAME)		CODE No.	ACCT. No.	PRICE	AMOUMT	

TO BE USED FOR ________

LOCATION ________

APPROVED ________ SIGNED ________

Form H

the complaint men, before leaving, are supposed to go over all gas burning appliances, and lighting fixtures in the customer's premises. The purpose of this is twofold. To give complete satisfaction to the customer, and to avoid a second trip within a short period of time for an adjustment of one of the appliances that could have been taken care of before.

Investigation and time study made of this work has disclosed the fact that a man can cover twelve complaints a day. Each man is given from thirteen to fourteen orders a day to insure keeping him busy. His work is collected from him at his home each night which obviates the necessity of his coming to the shop and permits him to stay in the field up to the last minute. The complaint men carry with them small supplies such as mantles, cylinders, tips, burners, springs, etc., which they sell to customers when necessity arises in making adjustments that require repairs. This is all done on a credit basis.

Emergency complaints are taken care of by men traveling on motorcycles with side cars. These men take care of all meter and house pipe trouble. They carry meters and pumps and call at the shop at the beginning and end of the day. During the day they keep in touch with the shop by telephone for additional work and for any emergency calls. The meter men may be supplied with a horse and wagon or an automobile. In working the orders the men should reverse their direction of operation each day. That is, if today they were working from east to west, tomorrow they should work from west to east. This is done to insure reaching a call that was missed the previous day on account of being at the other end of the route. No man should turn in on the second day an order not reached which had that same status on the previous day.

296—8-22—MP. Fitting Dept.

PIPE ORDER

	DELIVERED		COLLECTED		USED		PRICE		AMOUNT	
	Black	Galv.	Black	Galv.	Black	Galv.	Black	Galv		
3/8"										
1/2"										
3/4"										
1"										
1 1/4"										
Boiler Tubes										
Bag No.										
			BY				TOTAL			
			DATE							
			REC'D BAG NO.							

Form I

In the description of the Order Taking and Order Executing Departments just preceding, the Committee has treated of a system applicable to the larger offices. A medium size office of approximately 10,000 accounts would present the same need for studying the customer's convenience and for making that part of the office devoted to this work as readily accessible and conveniently arranged for the customer, but necessarily on a smaller scale. The work, under ordinary conditions, could be looked after by one properly equipped clerk who at rush times might be assisted and relieved of answering the telephone while engaged with a customer. This clerk also acts in the capacity of a floor man and if he is engaged on the floor in making a sale of merchandise, and another customer comes to the

G 13—100M—1-23.

REGULAR GAS METER APPLICATION

Application No.................................District, June 27, 1923 19

I ....hereby make application to the .... for Gas, to be supplied to the

premises No. 18 Elm St., ...Street 1st ....Floor..................Munic.

occupied by me ....as a flat, ...and agree to pay for the same promptly, at the regular price and according to the rules of the Company as printed on the back of this application, also to hold myself responsible for all gas consumed on the said premises until forty-eight hours after written notice has been duly given at the office of the Company to discontinue the supply.

It is further agreed that the duly authorized agents of the said Company, shall have free access to the meter and its connections at all reasonable hours and for any purpose, and may remove the same, and may also, upon my failure to comply with any of the rules of the Company, sever the connection with the service pipe, and discontinue the service.

The .... reserves the right to remove this meter, if same shall be in use by any other person than the applicant, on notice in writing from the .... to the undersigned.

Consumer's Ledger, Folio................................ Frank Brown,

Size of Meter - - .... 13 Elm St.,

Deposit No.................Am't $..................................

Application Taken by - ....H. Sheplin,

REGULAR
GAS METERS
ARE SET BY

UNDER THE FOLLOWING CONDITIONS:

1. Notice of discontinuance is to be given, in writing at the office of the Company, at least forty-eight hours in advance.
2. The meter may be removed if the consumption of gas shall be less than one hundred cubic feet per month, or the meter injured.
3. Employees of the Company are to be allowed free ingress and access to the meters to inspect, exchange or remove whenever deemed necessary by the Company, provided it be done within reasonable hours.
4. The Meter and supply pipes thereto are to be protected from frost and injury as far as possible, and never to be removed or disconnected by the consumer.
5. In default of the performance of any agreement made with the Company, it shall be authorized to enter the premises and remove the meter, or otherwise stop the flow of gas.

STATEMENT FOR CREDIT

Owner or tenant of premises to be occupied

.................June 30th, 1923.................

How long has prospective customer occupied premises..

Previous Address......30 Lake St.,..........................

....

Use Gas there?..Yes..

Business or Occupation......................................

With..

At..

APPLIANCE REPORT.

Piped?...
Service in?..
Meter in?..
Fixtures Hung?...
Gas Range?.................... Connected?..............
Water Heater?.................. Connected?............

Form No. 1

counter to give an order, sign an application, make an inquiry or complaint in connection with service, that customer is taken care of by some other clerk who may be assigned to relieve the regular order clerk when otherwise engaged. This relief clerk, when not actively engaged at the counter, is doing the clerical work such as typewriting, answering telephone calls and filing.

A customer applying for service for the first time or for transfer, is presented with an application (see Form 1) for signature. From this application the proper Shop Order is made out (see Form 2) or Turn-on (Form 3). Upon making the first application for service the customer, unless he has an established credit record, is requested to make a deposit for which deposit receipt (Form D) is given, the stub being turned over to the cashier upon payment.

Discontinuance of service is made upon application of the customer, at which time he is requested to sign a Discontinuance Order and at the same time a Shut-Off Order (Form 4) is made out.

In the event of a customer applying for service and it is found that there is no connection on the premises with the street main, his signature to the Service Application (Form 5) is requested and at which time a Service Order (Form 6) is made out.

All Shop Orders (Forms 2, 3, 4, and 6) are made in triplicate, the triplicate copy being retained at the Order Counter for follow-up purposes, and the original and duplicate copies being sent to the Operating Department. In the Operating Department, the original is turned over to the workman for performance of the order while the duplicate is held in the Operating Department office against him

DISTRICT	REGISTER No.	ORDER No.	SET REGULAR
Newark,			
Location 18 Elm Street,		Where Used 1st floor	MADE UP BY H. S.
Name Frank Brown,			Date 6-27-23
Moved from			ORIGINAL
Co. No.	Security		ENTERED
Size			Cons. Led. { Folio
Maker's No.	No. of Rooms Range		Line
Index	Remarks		Sum. Bk.
Set by			Meter Rec. Bk.
Date			Add'g

Form folded in triplicate. Reverse side of each ticket used for report.

Form No. 2

DISTRICT	APPLICATION NO.	TURN ON ORDER NO.	TURN ON
Newark,			

Location 40 Park Avenue, Where Used } 1st

Made up by H.S.

Name M. Teague,

Moved from

Date 6-27-23

Co. No.	Security	ENTERED
Maker		Cons. Ledger { Folio
Size		Line
Makers No.	Remarks	
Index		
Turned on by		Addgh.
Date		

Form No. 3

Form folded in triplicate. Reverse of original provides for customer's endorsement of satisfaction with work performed.

DISTRICT	NOTICE TO SHUT OFF	WHERE USED	SHUT OFF
	July 5th, 1923.	1st floor	Order No. L-675

Street 40 Park Avenue, Munic. Newark,

Made up by H.S.

Name M. Teague,

Date 6-27-23

Key at	Co. No.	ENTERED
Moving to	Size	Folio
252 Market St.,	Mkr.'s No.	Line
Bill to Newark, N. J.	Index	
	Shut Off by	Final Bill Made
Remarks		
	Date Hour	Serial No.

Form No. 4

G 61—10M—6-22

SERVICE APPLICATION

No.................... June 27, 1923. 19

Application is hereby made to to lay a service pipe from its street main to the premises No. 18 Elm Street, east side, between Mulberry St., and Columbia St., of which Frank Brown, is the owner.

I hereby agree to pay for service pipe in excess of fifty feet from curb line at the following rates:

Pipe up to and including 2" in Diameter @ 50c. per toot
Pipe in excess of " " " @ Cost

No Charge unless service pipe is over fifty feet in length from curb.

Factory........ Store........ Dwelling Yes

Piped........ Gas Engine........ Range........

Application taken by H. Sheplin,

Frank Brown,

Address of owner or authorized agent 18 Elm St.,

Form No. 5

G 53—5M—1-21.

SERVICE ORDER

Order No. 6239

District.................... Town....................

No. 18 Elm Street, Street

Between Mulberry St., St. and Columbia St., St.

Name Frank Brown, Date 6-27-23

Kind of Building Dwelling,

Used for Owners address, 18 Elm St.,

Gas Appliances....................

Date Service Installed.................... Size..........

ORIGINAL Signed....................

Form No. 6

Form folded in duplicate.

DISTRICT	VERBAL MAIL TELEPHONE X	ORDER No.	**LEAK**

Location 40 Park Avenue, Where Used } 1st floor

Made up by H.S.

Name M. Teague,

Date 6-27-23

ORIGINAL

Nature of Leak

Locate leak at meter,

Previous Order

Remarks

Co. No. Index

Date Attended to by

Form No. 7

Form folded in triplicate. Reverse of each ticket provides space for report.

DISTRICT	VERBAL MAIL TELEPHONE X	ORDER NO.	**COMPLAINT**

MADE UP BY H.S.

Location 40 Park Avenue, Where Used } 1st floor

Name M. Teague,

DATE 6-27-23

Nature of Order

No Gas,

Meter No. Size Index

Date Attended to by

Form No. 8

Form folded in triplicate. Reverse of each ticket provides space for report.

for completion. On completion of the order the necessary information is filled in, such as date, index, etc., and is then returned to the Contract or Order Department where it is checked against the follow-up copy and then forwarded to the Accounting Department for entry on the customer's ledger.

In cases of leaks (Form 7) is made up upon receipt of verbal, mail, or telephone advice from the customer and follows the same course as all other orders but takes precedence in execution over all other orders.

For other complaints in connection with gas service and adjustments of appliances (Form 8) is used which is made up upon receipt of the customer's advice and follows the same course as the previously described forms.

It is the practice to check the pending file of these orders in the Contract or Order Department at frequent intervals to ascertain whether any are being held for an undue length of time, if any are so held to learn from the Operating Department, in addition to the usual unfinished daily work report, the reason, or reasons, for such delay in order that the information may be transmitted to the customer upon his inquiry, or so that notification can be given to him if for any reason the order can not be worked.

For an office of the size to which this description of the Contract or Order Departments applies, the Merchandise and Appliance Department as described in the plan for a larger office is equally applicable.

The selection of the right personnel cannot be too strongly stressed in connection with the Contract or Order Department work and the Order Executing Department work. Regardless of the ideal lay-out of the office and the simplicity of the system, unless the employee realizes and appreciates the value to the Company of creating the proper impression upon the customer, the efforts of the utility company to build up good-will on the part of the customer will go for naught.

REPORT OF THE SUB-COMMITTEE ON HIGH BILL COMPLAINTS

G. M. Hergesheimer, *Chairman,* Philadelphia, Pa.

In treating this subject we hope to make an appeal to gas companies generally to attach greater importance to this class of work. We all agree that the good will of the public is one of a utility's greatest assets; therefore, to properly care for the dissatisfied—the customer with a grievance—is our manifest duty if we hope to attain this good will and meet with that degree of success for which our respective companies are striving.

Probably in no other way can a gas company better learn of a customer's dissatisfaction or grievance, or putting it in another way, probably it is never more evident that dissatisfaction or grievance exists than through the medium of a high bill complaint. Going further, it is only too often found that a troublesome complaint of high bill is really due to a happening or condition, either fancied or real, antedating the high bill complaint by some period of time. The receipt of a bill, perhaps only slightly higher than for the previous corresponding period, results in the customer's relieving his pent-up feelings in no uncertain terms.

Now—how should such matters be handled? The answer in a broad sense is apparent to all of us. First, to select high bill men of attractive personality, combining good appearance and good address, men of infinite tact, patience and judgment, plus (and this is most important) a versatile knowledge of the business. These you say are big qualifications, requiring high grade men. They are, and we feel that gas companies generally must awake to a realization of this fact and give a remuneration commensurate with the work rendered; but bear in mind not all of these qualifications are inherent, many being acquired by a proper course of training. We were taught in our student days that the three principles of science are—Observation, Experiment, and Reason. How fitting these principles are to the trained high bill investigator. Again, we like to think of an examination of a high bill as we were taught to look upon Cause and Effect. Every Effect has a Cause and every Cause an Effect, and so on to the final cause. The high bill is the effect and must have a cause; therefore, the more trained the mind, the more certain of finding the cause.

The act of removing a meter for test is in no sense a cure-all. It may satisfy the gas company, but does not always in itself satisfy the customer. What the customer desires is to ascertain the cause of the increase to make the satisfaction complete. The high bill man, not having supernatural powers, this cannot always be accomplished, but the fact remains that the man properly selected and receiving proper training, can, in a great number of cases ascertain the cause, and

where necessary take the proper corrective measures.

Several State Public Service Commissions have gone on record that the rate of return allowed is affected by the service given. One Commission has said that if the public is satisfied and the operations of the company are efficient, the company should be allowed to earn 8%; if the corporation is not so well managed and the public satisfied, it should be allowed to earn 7% with lower rates, according to the classification, their idea being that there is a premium for good service and a satisfied public.

A recent editorial in a well-known journal, in treating of public relations, contained a statement that the handling of complaints was the job of an exceptional salesman, as work of this character requires a selling ability of the highest type. One company, dominated by similar views, has for some years designated men in this department as "Service Salesmen," conveying the thought that they are high-grade men understanding their business and selling a commodity. This particular company in extending this policy stated there has been nothing done, including operations, improved machinery, etc., which has had a further reaching and better effect than the establishment of a department which primarily is attorney for the people. This is not heroics or a hysteria, but a payer of material dividends.

Proceeding to the receipt of the complaint, let us assume it is made verbally. The customer should be directed to the portion of the office reserved for this class of work—a place removed from the general order and complaint desk. Here, and not within hearing of another customer who desires to make a like complaint, the case may be discussed by a trained man, with the aid of the gas ledger and any other record deemed necessary. Some cases, usually the minor ones, or where prima facia evidence is sufficient to convince and satisfy the customer beyond a doubt, may be settled then and there, but we are averse to spending much time at this point of contact. The company which strives to settle all its complaints in the office is fooling no one but itself. It is going contrary to the laws of psychology or human nature, call it what you will. A visit to the customer's property and the usual examination and re-reading of the meter has a psychological effect of a palliative nature far beyond a discussion at the office. The people may like to be fooled, as has long ago been said, but our customers are not so ignorant as to believe that meter registration may be proven accurate by an office discussion without a visit to the complainant's premises. They may leave the office awed, or apparently satisfied, but in the calm light of day, after reviewing the discussions, the truth is forced upon them that their complaints have not been given proper consideration. This is the beginning of ill will.

The form for transcribing a high bill complaint should be conveniently arranged with sufficient spaces for the following data: Dates and meter readings with consumption, number of days covered by the bill, with the average daily consumption, the date of issuance, the company's number and size of the meter, the date of high bill man's visit, with the consumption from the date of bill reading, the number of days involved and the average daily consumption. It is also advisable to have printed space requiring the high bill man to make written answers, such as: "Any leak," "Meter to be tested," "If so, did you invite customer

to witness test?" Also, printed spaces for at least two or three years' consumption, which should be filled out by the office force.

The high bill man, being thus equipped, is ready for a visit to the premises and here his real work begins. First impressions are often lasting and mean much; therefore, the manner in which the customer is greeted has an important bearing on the case. It is usually advisable to light a burner at a convenient point, preferably near the meter, then proceed to read and make an examination of the meter. Any leakage should be determined and the consumption computed from the time of the bill reading, together with the daily average consumption, to compare with the average during the period covered by the bill. The latter has a very important bearing on the case, as the increase or decrease in consumption to the date of the visit should guide the high bill man in his course of action. The appliances should be inspected to see that they are functioning properly, and right here may, perhaps, be found a cause for the increase in consumption. In talking with the customer, endeavor to win his confidence, impressing upon him that you are there in a spirit of helpfulness; that it is the company's desire to teach economy in the use of gas so that each customer may obtain proper value for each cubic foot of gas consumed. With confidence inspired, the high bill man is on the road to success. We will assume he has observed closely all conditions affecting gas consumption, then with the customer's confidence gained, he can ask such questions as good judgment and tact will warrant, either as a result of his observation or otherwise. As a result of these observations and questioning, which we will call experiment, the high bill man is in a better position to reason.

It might be well to remark at this time that there can be no cut and dried method of handling high bill complaints, no stereotyped line of talk. Broadly speaking, the examination should be along the above-mentioned lines, presenting the conclusions to the customer in the way which will best appeal to each individual, remembering that after all a certain knowledge of human nature is essential to success. The peculiarities of each case must be studied to make the strongest appeal. The road to success in this work can be summarized briefly as so much natural ability plus still greater study and hard work.

Much can be said in favor of a high bill man having sufficient knowledge of all appliances to determine whether they are functioning properly, as by putting this knowledge to proper use, the expense of changing a meter for test, or of installing a complaint meter, can often be saved.

In training high bill men, meetings should be held where the operation and construction of a meter can be thoroughly explained, where the entire mechanism can be viewed and all questions answered. Further meetings in series, should be devoted to the complaint meter; its construction, operation, and function (having a complaint meter set in tandem with an ordinary meter at the time). Appliances should not be neglected in this series of meetings, particularly automatic water heaters, showing and explaining the different types.

The men should be taught proper combustion and adjustment, and to recognize defects. They should be encouraged to ask questions and to submit their problems and their experiences for mutual profit.

In aggravated complaints, where it is deemed advisable to go beyond the ordinary measures to satisfy, it is well to consider which course is preferable; namely, changing the meter for special test, or the installation of a complaint meter. The latter device is a meter which will record the time and rate of speed at which gas passes through it, and is essentially an ordinary dry meter equipped with a mechanism for making such a record. It is an invaluable device when properly used, and offers opportunities to satisfy a complainant when other means have failed. Its use is indicated in aggravated complaints where the gas consumption is keeping to the same level, or a higher level than that of the period of the disputed bill. Under decreased consumption it seldom has much or any value. It is particularly adapted to homes where one or more maids are employed, where homes or families are large, to business places, or more generally speaking, where the consumer of record is not in position to form a fair idea of how the gas is used. Many astonishing and interesting results and many humorous tales could be recited from the use of this device.

The complaint meter is usually set in tandem with the house meter, and when so set may be used to a certain degree, besides performing its principal function, to test the accuracy of the house meter. It may also be used on any part of a pipe line, such as a range or water heater line. Sometimes such an installation as this is most advantageous. The high bill man may come to the conclusion, as the result of his investigations, that a certain appliance is used to a much greater extent than the customer realizes. By placing the complaint meter on the line supplying this appliance, the consumption of gas through the particular appliance can be obtained in units of 5 or 20 cubic feet according to the size of the complaint meter.

In comparatively rare instances of aggravated complaints where the consumption is great and automatic water heaters are used, the complaint meter can be used with truly wonderful results by installing it on the water heater line in conjunction with a water meter, the latter being placed on the water line to the heater. In this way the consumption of gas through the water heater is not only obtained just as used, but the water meter furnishes the amount of hot water supplied by the water heater. It is, therefore, a simple matter to compute the number of gallons of hot water obtained for one cent, or the cost per gallon of heated water. Taking the consumption as shown by the house meter into consideration within the same period of time, the percentage of gas used through the automatic water heater is obtained with the percentage of gas used for all other purposes. The results thus furnished are usually astounding and also do much to popularize automatic water heaters when costs are so figured. It frequently shows, however, that much hot water and, consequently, much gas is wasted. Showing the source of waste offers an opportunity of prevention.

When changing a meter for special test, it is advisable to offer the customer an opportunity to witness the test, where each step in the procedure can be explained. Few will avail themselves of this opportunity, but even with those who do not, it has a certain psychological effect, showing the company's spirit of fairness and honesty of purpose. However, before changing the meter, it is usually the part of wisdom to give the customer some conception of the meter test

and its reliability as a conclusive or positive factor in determining whether the meter registered correctly or incorrectly the amount of gas passing through it.

We have all met with particularly aggravated complaints, involving some unusual features, and where seemingly the customer could not be satisfied. We believe it distinctly advantageous to have a man to specialize in such cases; a man of high calibre and training and of peculiar fitness.

While the treatment of high bill complaints is today being recognized as a most important branch of our industry, and consequently beginning to receive the attention it deserves, we must not, if we wish to progress, devote all our energies to treatment or cure and overlook another angle of the subject of paramount importance; namely, prevention. This should and must be considered. It is a synonym of efficiency. The trend of the times in medicine is the prevention of disease rather than the cure, and while it is a far stretch from that profession to our line of business, the thought is nevertheless applicable to ourselves. How much better it would be if we could prevent high bill complaints rather than build an efficient staff for their cure. We know this can never be wholly accomplished, but we can by slow painstaking endeavor accomplish it in part. How, you ask? The answer is obvious. Teach faith in the gas meter and continually encourage customers to read their meters periodically and keep a record of their gas consumption daily or weekly, as they would any other purchasable commodity. Relatively there is no difference. To further this, cards should be printed, explaining their purpose in an interesting way and containing a drawing of the meter dials, with instructions for reading the meter. The back of the card should be ruled to permit entry of the date, index and amount of gas consumed. The high bill man should give these cards to customers and interest them in their use. They should also be given to customers at the office as occasion will warrant. The results from such a method will be slow, but by constant education and encouragement will be productive of much good.

It has often occasioned wonder why such an accurate and reliable device as the gas meter is so much abused. We gas men are to blame for this lack of faith. Neither those who preceded us in the early days of the industry, or we ourselves have done much to dispel this delusion and acquaint the customer with the true facts concerning the meter as we know them. Neither have we made any concentrated effort to teach customers to read their meters and keep records of the cost of the gas consumed. If this had been done long ago we would not now be reaping the results of the neglect. If this is true, let us make up for the mistakes of the past and build for the future. We all admit that we want our customer's good will and are sincere when we continually preach this doctrine, but we might, to good advantage, analyze ourselves and see if we are really practicing in every way what we preach.

DISCUSSION

(Development and Education of Personnel)

P. W. Herring (Chicago, Ill.): On the proper selection of help, I find, especially in the larger gas companies, that you either have to take from the force within or go on the outside. From outside sources there is the advertising

medium and there are the schools and colleges to draw from. But in making our selections, we ought to try, at all times, to advance employees within the different departments to the higher jobs.

I find there is an attitude on the part of department heads to perhaps hold back the talent in their departments. In this report it says that the Employment Manager carries more or less the burden in connection with securing the right kind of help to fill the job. That burden could be made much lighter if those in charge of the departments would inform the Employment Manager, from time to time, of the people in their departments who seem to make more progress than the average employee.

Referring to the training and educating of employees after they start to work, I think there is a disposition to let the employee drift along from the time he starts in. We aim to train him in the gas business by having classes and general instruction from the department heads and supervisors. But there seems to be a leaning toward having the employee go outside to get his education and I have had that to contend with right along in connection with personnel work.

Lack of co-operation on the part of department heads in the training, educational work and instruction that the employees ought to have, is the most serious difficulty.

I am working out a plan right now wherein department heads will cooperate in talking to a group of employees about the particular part of the gas business that they have to do with.

W. A. Doering (Boston, Mass.): Mr. Short merely refers to men making complaints. Probably forty per cent of our business is done with the ladies, and presumably they might feel more at home talking to a woman complaint clerk.

I do not agree with Mr. Short on the question of ladies in the Application or Complaint Departments—I think we should have at least one or two.

The average employee is very apt to agree with the bosses in anything they may suggest, whether right or wrong. Therefore, I believe that training without the company is the most essential. I do not mean this training should be an accounting course. Have the instructor come into the office and obtain from the various departments the routine, and then try to put that across to the employees. They will take it far more readily from an instructor than they will from a department head.

H. M. Brundage (New York, N. Y.): The committee is right in the general proposition that men at the complaint desk and at the application desk certainly do better work and much more efficient work and do more to create a spirit of good will among customers than women. I believe that is pretty generally true all over the country, excluding, of course, Boston.

George H. Albrecht (Baltimore, Md.): We tried out women during the war but soon came to the conclusion that women were not suited to handling complaints. We also had women in the application work, and have since replaced them with men. I do find in Baltimore, however, that we handle a lot of women, but, we believe that a woman prefers to deal with a man in the matter of a complaint. We believe the story of service gets across better than it does with a woman.

W. H. Barton (Portland, Ore.): Mr. Doering has the cart before the horse.

In any case where we should have women at the counter, it should be to wait on the men. I think the ladies would all prefer men to wait on them. We have followed that practice.

We do not have women at the telephone or counters in any case except as tellers.

I think that the source of supply for employees would not be such a worry if more effort were put forth to holding the employees that we have. Even though we do not have employment departments in the smaller companies, if each department would keep a record of the labor turnover, we would find reasons why employees left that we could iron out. We find that of considerable advantage in our own company.

We put in a series of lectures two or three years ago and concluded to discontinue them in that form. We distribute the printed lectures in advance and those at the meeting are permitted to ask questions for fifteen minutes. The high points of the lecture are brought out for fifteen minutes and then for fifteen minutes a quiz is carried on and the employees are asked questions.

I think an organization manual covering each activity within the departments is a good educational factor, enabling employees to learn their work in better shape and the manual can always be enlarged by studying other activities in the office.

O. F. Potter (Newark, N. J.): We have long recognized the value of education. Some few years ago we had a great many of our men take advantage of the educational courses of the N. C. G. A. They served a very good purpose and I think many of our men were greatly benefited. For some little time past we have had an educational supervisor whose duty is to go around among the offices and arrange for some systematic method of education. We have not as yet outlined a particular course, but we have been convinced that some education within as well as without the company is necessary.

There should be some little attention given to the subject of ethics as a part of our education. We may learn all about the proper way of posting our books, taking orders from customers, how to answer the telephone and how to take money from our customers, but I believe that in conjunction with the book-learning, if we could instil something in the line of ethics in the minds of our employees in order to avoid a possibility of a short answer, or an irritated clerk giving a customer a reception that is not quite agreeable, it would result to our benefit. Whatever foundation of ethics we bring to the company when we enter its employment, nevertheless we should all be reminded of those particular things that make for pleasant relations with the public, and, what is very important, pleasant relations with each other. Each one of us should feel that we are among our friends and I would like to have the public feel the same way when they come among us—that we are bound to treat them with respect.

We have, under the direction of Mr. Watson, our educational supervisor, a cadet system which has given us, very fortunately, a number of very splendid young college men who are bringing a high grade of thought to our business These men probably will become executives or department heads and with their broad viewpoint they will be of great help to us.

On this card which was left on the chair, I suggested as a thought to be

carried along to the committee that will follow us, "A cadet system for commercial and accounting departments."

The operating departments for many years have drawn their future supply from college men, and while I do not suppose college men have any monopoly on brains, nevertheless they have cultivated minds.

R. L. Fletcher (Providence, R. I.): While Mr. Short is too modest to speak of it in his report, one of the most effective pieces of educational work put out by gas companies is the stunt he is running now in Providence.

He sends the employees every two weeks a card which is personally signed by himself, giving one idea at a time. The card is made up attractively and the idea is not too technical. Sixteen cards have been issued to date covering a variety of subjects. I happen to have a few of them with me and I will pass them around. We employ approximately 250 men, and I have not seen more than two of these cards thrown away in my walks around the plant. They are given to the employees when they are in working clothes. We have taken pains to see that they do not get them on pay day so there is no connection between the pay envelope and the educational work.

In our educational work, we never say we have lectures—we have talks. We never have more than ten men at a time and we try to talk to them as we would talk to each other, not as a professor. We attempt as far as possible to call them Bill or Joe. During one of these talks we came across an emergency man who had been with the company twenty odd years and yet he was under the impression that when a match blew out in lighting a gas fixture, there was air in the line. We talked about twenty minutes to convince that man. That shows the need of our employees having more information if anything does.

De Witt Clinton (Worcester, Mass.): There seems to be a division of opinion as to the complaint clerks. I am going to suggest that you do the same as we do in Worcester. We have a man and a woman. Let the customers take their choice.

H. M. Brundage (New York, N. Y.): Before we close the debate on this report, I want to put over a heart-message to you with what limited skill I may have. I want to say to you men, (who I assume are the heads of the accounting departments of gas companies in the United States) what I said in the fall of 1920. I charged them to their faces, even at the risk of being thrown out of the room, that taken collectively they were a bunch of pikers and I repeat that here now and I will tell you why.

You gentlemen are running these accounting departments of these great gas companies all over the country. You saw the war come; you saw the purchasing power of the dollar fall until in the fall of 1920 it had reached a point somewhere around fifty or fifty-two cents. You gradually saw it come up for awhile, but, for the last six months it has been going down again.

You have seen your executive officers continue to increase the cost of labor in your plants and distributing systems and in your mechanical departments, without limit almost, in order to hold the organization, but, from such figures as I can obtain from the Federal Trade Commission and the American Gas Association, the labor turnover in your accounting departments is pretty nearly as bad as it was in 1920.

In saying this, I want to criticize my good friend Short, not for what he said, but for what he failed to say. What he said was magnificent and I think all of the men are in accord with it, but he did not say the vital thing. We are having a tremendous turnover in our accounting departments because you accountants at the head of your staffs have not the backbone to go to the executive management and require and urge and plead with them that your clerical force be compensated sufficiently so that they will at least be paid equal to what the dollar purchased before the war.

You gentlemen, as a body, have not done your fair and honest duty and I charge you to your faces that I know such a condition exists because of the reports I have seen. When you go home tonight, get down on your knees and do not get up again until you consider you have backbone enough to take care of your own people when you get to your homes, and support your organization even at the cost of your jobs.

Walton Forstall (Philadelphia, Pa.): Mr. Brundage beat me to it. I was just about to say what he has said. It is not only your labor turnover that proves that you are not paying your men enough; you may not have the turnover and yet not be paying your men enough because they may be a lot of specimens who have not sense enough to leave.

There is no doubt in my mind that there is nothing more important for the head of the department to do than this. It sometimes takes a lot of moral courage, it sometimes is the last thing that a man wants to request, but he ought to realize that it is his business and even if he does get turned down, he has done the best he could.

F. H. Patterson (Rochester, N. Y.): In Rochester we have ventured into practically every one of the educational features that Mr. Short has brought out. I doubt that we have held tenaciously enough to some of the more desirable ones. I think our difficulty is due primarily to the fact that our employment department head is also the editor-in-chief of the house organ and head of the safety department, with the result that employment suffers. I was convinced in the last month or so in hiring help for comptometer machines, that we have not adopted the proper weeding-out process.

The comptometer manager in Rochester has established a very fine system of education and all of the employees that we have obtained from him are very excellent. I have suggested that a careful weeding-out should be done in our own company.

I am firmly in accord with Mr. Short that men should be employed on the complaint counter. We rely upon men and I think there is enough of the clinging vine element in the most masculine woman to make her want to lean on a man.

T. V. Purcell (Chicago, Ill.): I agree with Mr. Brundage and Mr. Forstall on the importance of paying employees in our accounting departments enough. But generally, in any organization, too little attention is given to the proper arranging for promotion. I think that is important enough, in the larger companies at least, to require quite a system so that the positions throughout the whole organization are graded and the employees will know what higher positions they are eligible for, and their education and training can lead up to the promotion to those higher positions.

W. A. Doering (Boston, Mass.): It has been customary for years in the Boston company to promote a meter reader to a prepayment collector and from there to a collector and after he has served in the collector's department for awhile, if there is a vacancy in the local office, to put him in as a cashier.

Never allow a position in the collection department to be filled by an outsider who has not graduated from the meter-reading force.

There are other things that make satisfied employees besides pay. We have a profit-sharing plan in which I think about ninety per cent of the employees are participants. A number of the employees have found it to be the only means of accumulating money. We also have a very liberal pension system—two per cent for each year of service on the average pay of the previous ten years. We also have a group insurance plan. The employees do not contribute one cent to any of these.

In our meter-reading department in the past six months we have had a large labor turnover but we hope to eliminate that shortly. In the order department we have had the usual turnover, due to young ladies insisting upon getting married. Sometimes they come back after getting married but I hope to eliminate that practice.

A. R. Keller (Syracuse, N. Y.): Unquestionably we should pay a man what he is worth. We have all gotten beyond the days when an accountant was considered only an expense. But we also want to make sure that we do not pay some more than they are really worth and possibly, by eliminating some of the undesirables, we will have more money for the individuals who are deserving.

At this point Mr. H. O. Jones, Chairman of the Accounting Section of the National Electric Light Association, was introduced and addressed the meeting. He complimented the section on the splendid attendance and interest in the discussions and spoke in favor of closer cooperation between the associations, particularly in the Accounting Sections where so many of the activities were of common interest. Particular reference was made to the Uniform Classification of Accounts, Depreciation, and the joint activity of the two associations with regard to the bulletin issued recently by the Bureau of Depreciation of the Interstate Commerce Commission.

DISCUSSION

(Credit and Collection Policies)

Chester Grey (Lansing, Mich.): Most of these papers seem to have covered the larger situations, but my experience has been with a smaller property—fifteen thousand or sixteen thousand meters—and the problems are quite different.

Apparently a good many people are not taking any deposits from the guarantors. I would like to do that but have never been able to arrive at just that point.

About two years ago our commission ruled that all deposits that had been with us one year should be returned. We finally succeeded in getting most of the companies in the state together to have that eliminated as an interference with management.

An analysis of our bad bills, indicated forty per cent had used gas over four years. I believe the deposit simply takes care of the last bill or two and if we eliminate the deposit how shall we collect these last bills?

The smaller companies, in training employees, cannot get all college graduates and the office manager has to be selected with a great deal of care as he may have to do pretty nearly everything, even the janitor work occasionally. Employees for the order counter or collector should be taken mostly from the distribution departments as their experience there gives them a general knowledge and they are able to give a better impression to the consumers.

I think that too much time is taken up in trying to settle complaints in the office. Outside of settlement of dates and a few minor propositions, it is better to send a man to the premises where the complaint can be settled with greater satisfaction to the customer.

That is a very good point—to transfer the address and bill of a customer who has moved. A great many unpaid bills are final bills which can be collected from the consumers at their new address without much effort if the follow-up system has been a good one.

W. H. Barton (Portland, Ore.): I like the optimistic tone that ran through this report. You do not usually find that in reports on collection and credit.

We have made the compromise referred to on contracts. If the application is taken over the telephone we do not send our contracts out for signature if it is a domestic customer. We save a lot of time and are just as well off without the contract. You resort to suit very seldom, in a domestic case. Even then it is usually easy to prove occupancy and your account is good just the same.

We have discontinued taking guarantors, deciding, after many years study, that you create more enemies than friends by making collections under such conditions.

We have adopted in its place the practice of referring to other cities. If the party has used gas once, that settles it. We send out a reference form quite extensively and have collected bills from other cities by this method. Our replies have been full and complete, and only one city has refused to reply.

If the customer has not used gas in some other city, but has established a local department store account, we give him service and get further information from the department store. We do as little in the deposit and guarantor line as we can.

Regarding the refund of deposits, I agree that the loss occurs at the time the final bill is rendered, but that may be ten years after the man started to use gas. Again we compromise by returning the deposit from residential users upon request after one year if the bills are paid promptly. In commercial establishments we do not, because the hazards are just as great after one year.

W. A. Doering (Boston, Mass.): You can create considerable good will if you will send your customers a letter such as shown in this paper, advising them that you consider after one year that their account is good and you are pleased to return their deposit.

The smaller company has an easier problem than the big company, as they have personal contact with their customers and know their habits.

The suggestion for guarantors, I think, is a good one. Most of us will take a guarantor and never think of releasing him.

Often accounting departments are blamed for holding up sales pending receipt of credit information. More often it is the over-anxious salesman who is to blame, because, in concentrating on his sale, he fails to get the proper references and information and therefore the accounting department must hold up the sales to get it later.

One good point brought out was the elimination of the word "rules." I know of one company that has a book of rules and in signing the application the customer agrees that he has read the book of rules.

The average contract has too much on it. The ideal form of application should contain no more than two lines. It is merely designed to secure the signature of the customer and is only used for the purpose of reference later on.

McMan (Boston, Mass.): We have about 60,000 prepayment meters. Although many people are against them, our people have been educated to their use, and they eliminate the billing, turn-on and cut-off work and bad bills.

I think their use is going to grow. If a man can not pay for the gas and you shut him off, you lose a customer but if it is a prepayment meter, you retain your customer.

We handle our application end a good deal like Chicago. We return the deposit after one year if a man pays his bill promptly.

H. F. Frey (Allentown, Pa.): I heartily concur in the recommendation as to guarantors, although our practice has been to accept guarantors from property owners only and to hold them until gas is shut off.

We hold deposits three years. The recommended form of letter accompanying the refund of deposit does indicate that you have faith in the customer and it should result in making him more careful to settle his final account.

W. H. Bischoff (Savannah, Ga.): I believe in deposits and, in a great many cases, that they should be held until the account is finally discontinued. Where requested, we do refund deposits if bills have been paid promptly. We do not, as a rule, accept guarantors, as the guarantor forgets the transaction when the account becomes delinquent, and thinks he should have been reminded of it sooner.

On industrial accounts, we have to get pretty good deposits, but we put their accounts on a weekly basis, so that a small restaurant consuming one hundred dollars worth of gas a month, can, on a weekly basis, cover the account with twenty-five dollars.

Homer Pace (Charleston, S. C.): Referring to the committee's recommendation that customer's name should be hand-lettered after the customer has signed the application.

We ordered our service department to follow this practice and in about eighty per cent of the cases the clerk could not read the name and had to ask the customer what it was. That resulted in a large number of complaints.

I would like to get some information as to the probable cost of collecting final bills. We have been conducting some experiments and have been very successful and I would like to know the experience of other companies.

J. M. Roberts (Chicago, Ill.): As to complaints due to inability to read customer's signature, these can be avoided if clerks are taught to phrase their questions courteously. If you cannot read the signature, the customer's name will be incorrect on your records and bills, and your customer is much more apt to take offense when he receives mail or bills with his name indifferently spelled.

O. F. Potter (Newark, N. J.): There is much food for real thought and digestion in this splendid report.

A liberal policy with regard to deposits and their refunding after a reasonable period, I think is one of the most splendid points whereby the good will of the customers will be retained. If a voluntary refund, it is bound to create a good impression.

As to the signature on the application. In our company we do exactly as he suggests. We print the name after the signature is obtained as recommended in the report and believe with Mr. Roberts that a proper method of asking the customer his name, if it is not decipherable, will not arouse his ire.

J. H. Brunnenmeyer (Springfield, Ill.): Springfield is located in a mining district where the population is pretty much transient. A year ago an investigation showed that sixty per cent of the money involved in final bills was being lost because fifty per cent of the population are miners who move out over night. Rather than refund deposits in such cases at the end of a year I prefer to collect the deposit a month prior to the time the party is going to discontinue the service.

We now enter our final bills immediately upon taking the last readings and have a collector take them out the following day to collect them. We have collected most of our final bills in that way. We advise customers that final bills will be presented in the course of a day or two, and it will be unnecessary for them to come to the office.

Recently the Illinois Commerce Commission issued General Order 109 requiring the refund of deposit and interest after one year. Various state associations, electric and gas companies met with the Secretary of the Treasury to try to eliminate that. Local conditions greatly affect the advisability of such a policy. The Central Illinois Public Service stated some of their experiences in southern Illinois. In one city populated by miners, eighty per cent of the population moved out over night during a strike.

Price (New Bedford, Mass.): We require deposits from everybody, no matter what their position. It ranges from four dollars for residences up to five, fifteen, twenty and one hundred dollars for small restaurants. We also bill in case the amount is too large to carry over. We pay five per cent interest on the deposits, although the law only requires four.

We do not make a voluntary refund but we look over past years' records and ask those people if they have their deposit receipts. A great mass of customers come at the end of twelve months and ask for their money. We think that asking deposits from everybody eliminates any prejudice that might occur on the part of some whose credit is entirely good. The Standard Oil Company had to pay their deposit to us.

We are looking through our deposit books now, searching the stubs, and are gradually sending notices to our consumers.

This report is so good that I am going to send two copies to our departments and have our men look it over and initial it.

DeWitt Clinton (Worcester, Mass.): We insist upon a contract as a business proposition. We never hold up service because of a delay in signing the contract, but, contrary to Portland, even with domestic consumers, we make out a 5 x 8 card contract, mail it with a polite letter welcoming the party as a customer of the Worcester Gas Light Company and asking that he kindly sign and return the contract in the enclosed envelope. That brings us a point of contact which Mr. Roberts' paper brings out so admirably. I think the thanks of this whole section are due Mr. Roberts for this admirable paper, and I think not only the heads of departments in every gas company should read this paper, but I am hoping that somewhere or somehow, the managers of every company will be forced to read this paper because there is a lot of meat in it that they can take right home.

We take guarantors in Worcester. We have the form right on the application, and while we do not now release the guarantors, my contact with the members of this committee prompts me to submit the following suggestion to department heads when I go back to Worcester: That the guarantee will read that for a period of one year he guarantees the account, but, that he is automatically released at the end of the year.

I felt a few years ago that we ought to return a lot of our deposits. I went through the list personally and returned a number of deposits because the bills had been paid promptly. At the end of a year, I found that a pretty good percentage of the people to whom we had returned deposits, had stuck us.

C. M. Cohn (Baltimore, Md.): I would like to make a slight contribution. I have not read this paper and I have heard only a part of the discussion. The thought that I would like to leave is this: As gas companies are engaging more and more in the sale of merchandise, on what has been said to be a merchandising basis, they are apt to find that their practices with respect to the sale of gas are not in harmony with those on the sale of merchandise. This difference in practices can be reconciled to the very great advantage of the gas business if the method followed in the conduct of the gas business was brought in harmony with the methods of the merchandising business.

In the sale of merchandise, in most cities, the business is conducted in competition with other dealers in appliances. It is, therefore, necessary to conduct it in a way that will enable the business to be run successfully in competition with the merchant who generally knows how to conduct a merchandising business.

He knows, first, that he is in competition and he also knows that it is necessary to adapt the means to the end—the end being carrying on the business for profit. He must keep within the lines of fair and honest dealings and must adapt these practices and the methods of conducting his business to the necessities of the situation. As gas men we can do no better than to check our way of conducting the gas business with the way a successful merchant in our town is conducting his business. I believe we can learn more about how to conduct the commercial end of the gas business by a consideration of how an ordinary mercantile business is conducted, than we can by comparing the methods pursued by various gas companies.

In Baltimore, if we are considering any change in the commercial practices, we are more prone to send out and investigate how similar situtations are handled by successful merchandising concerns than we are how those same problems are handled by other gas companies. This is said without disparagement of the methods of gas companies; it is just what might ordinarily be expected. Merchants, through the necessities of their businesses, are required to adapt themselves to their requirements in order to be successful and it is no answer for gas companies to say that their business is different, because after all, it is in very few respects.

In any particular town the gas men must realize that the town merchants are dealing with the same people that the gas companies are dealing with and if their methods of collection or credit work well and to the profit of the concern, essentially the same procedure will work equally well with the gas companies

The Chairman: The hour for closing was set at five o'clock. We were a little late in getting started, therefore, any who care to continue the discussion may do so.

DeWitt Clinton (Worcester, Mass.): That last talk was splendid but I wonder if there is not something vitally different between the gas company and the merchant. A customer of the gas company signs a contract, places a four or five dollar deposit with the company and gets unlimited credit. He can burn as much gas in two months as he wishes, as he always gets that much before you force collection. What merchant would allow that same customer to take out of his store an unlimited amount of merchandise on a deposit of four or five dollars? Therefore, I claim that the gas company cannot be run the same, as to credit, as the merchant runs his business.

C. M. Cohn (Baltimore, Md.): Under such circumstances what good would a four dollar deposit be?

DeWitt Clinton (Worcester, Mass.): Very little good, nor would it be any good to the merchant if the customer took fifty dollars worth of merchandise from the store.

C. M. Cohn (Baltimore, Md.): Is not that a fear rather than a fact? If the fear were well-founded the man could take as much gas as the pipe would permit in two months and the company would be in danger. The meagre five dollars would hardly guard against a situation like that and yet that is all the gas company exacts from an ordinary domestic customer and trusts him for the balance. Our experience in the business shows that danger exists to a very slight degree. You might just as well argue against the telephone company putting in unlimited service for a flat sum. The idea works out well on the average. Some people abuse it but the majority do not, so it averages up pretty well from what I know of the telephone business.

W. A. Doering (Boston, Mass.): There will always be dead beats and the dead beat is going to beat you no matter how many safeguards you throw around him. If you took a hundred dollar deposit, he would get two hundred dollars worth of gas. The department store has the same problem. The dead beats get on their books and pile up enormous accounts and then they go chasing them.

In the credit stores a man goes in for a suit of clothes and pays a dollar down and then try and get him after that.

The great majority of our people are honest and perfectly willing to pay their just debts, and I agree with Mr. Cohn that we should be more liberal and follow the policies of other businesses.

DeWitt Clinton (Worcester, Mass.): Mr. Cohn need only come up in New England when we have a coal famine and see the amount of gas that they attempt to take from us to heat the houses when they can not get coal. Then the fear becomes a reality.

McMan (Boston, Mass.): Many customers during the coal scarcity did steal the gas—in some cases out of necessity. But the large majority are honest and what Mr. Cohn well said is simply a fact.

In the sale of appliances I handle credit accounts just the same as the department stores. If a man pays his bills within a reasonable time, he gets credit. If he has not paid promptly, I find out why and then I sometimes give him credit. We have no discount system. Our unpaid bills are a small percentage of the whole.

T. F. McCarthy (Chicago, Ill.): In listening to the discussion of the gentlemen from different cities I get the impression that the morals of the people in Chicago must be far superior to those in other cities. It has been our custom to look for a reason why we should *not* ask for deposits instead of looking for a reason why we should.

After all, I believe that ninety-nine per cent of the people are honest. Because a man moves away or is in such distress that he is compelled to use gas for fuel is no reason why he would not pay for it. If a man buys groceries and changes his place of employment and has to move to another city, you expect him as an honest man to come and pay his bill. I believe that the loss from people moving out of the city or away from your territory is very small. Your losses are principally confined to people who can not pay.

A. F. Short (Providence, R. I.): I agree with Mr. Cohn that a gas company can handle credits very much the same as a mercantile establishment. We do in Providence and it seems to be very successful.

Duff (Fall River, Mass.): To me there seems to be an essential difference between gas companies and mercantile establishments. We are public service corporations and must endeavor to treat our customers all alike. Whether a merchant does that or not, I do not know.

Fall River is a mill town with a cosmopolitan population. We require deposits only in cases of necessity. We take a contract only for prepayment meters and only because they involve responsibility for damage.

After announcements by the secretary the first session was declared adjourned.

SECOND SESSION

Wednesday Afternoon, October 17, 1923.

The first order of business was the continuation of the discussion on the Report of the Committee on Relations with Customers.

DISCUSSION

(Coordination of Order Taking and Order Executing Departments.)

Morse Dell Plain (Hammond, Ind.): I do not know of another more important feature of our work in the gas business than the part covered by this report. Unfortunately, the average gas man does not feel that way about it and more than anything else, I would like to impress upon the executives here the importance of giving this particular feature of the work the fullest consideration.

We talk about public relations, but when it comes right down to brass tacks, there are no three things that apply to our industry that have as much bearing on public relations as this one proposition. It is the first contact the customer has with the company and it is a continuous contact and the sum and substance of it seems to me to be contained in that final part—the selection of the right personnel.

I was at a meeting not long ago where a change in the rate structure of a company was being discussed. I ventured to say that the application of that rate would entail quite a problem from the standpoint of the accounting department and one of the other men at the meeting characteristically said, "Oh, Hell, you can hire bookkeepers cheap; what difference does that make?" That is typical of the general attitude toward accounting.

While not an accountant, ever since I have had it within my limited power to do something, I have been trying to boost the accounting end of the game because it is the end of the game that needs boosting. Most managers are either technical or commercial men, and as a result give most consideration to those departments unless they are pretty broad-gauged.

Make yourselves fit to be managers so that accounting can get the fullest consideration, or make yourselves salesmen so that you can sell the accounting proposition to the management.

Selection of the right personnel, especially in your order department, is important. You can not get it for sixty and seventy-five dollars a month. You can not expect your manager to recommend increases or get into the details of your department. So far as he is concerned, the head of the department is

repsonsible and must get results. Therefore, it is up to the accounting men to sell to the boss the fact that they have got to pay more money for the right personnel to get results.

The accounting department should have its fair share of the appropriation for operating the company. We spend thousands of dollars to promote good will. If they would give a few of those thousands to you men to increase the morale and personnel of your department, that would go a long way to increase our good will in the company.

H. H. Newman (Trenton, N. J.): I think we all agree with this committee that a good first impression secured through the proper personnel on the order counter is usually a very lasting one. But unless that is followed up with good service we have a disgruntled customer. Close and intimate cooperation with our distribution departments is essential to hold the relations that we desire with the customer.

Frequently we do not do all we should. For instance, a customer coming in from some other city will bring his appliances with him. He orders a gas meter and we send a man up to set it. The next day the customer comes in and says, "Your gas is no good in this city. I never had any trouble with my appliances." Now all we did was to set the meter. We did not see whether the appliances were working properly, and of course, everything goes back to poor gas.

We must go further than getting good service into the order counter and setting meters promptly. When a man goes to set a meter, he ought to inspect the appliances and see that everything is giving the proper service.

Our customers stay with us all the time and we must back up the first good impression with continuously good service, or we lose the value of the first impression. One case of poor service is always held against the company no matter how good the previous service may have been.

Ewald Haase (Milwaukee, Wis.): The Epistle of the Romans says somewhere that faith without work is nothing.

What I mean to do with this paper, is to have my department heads make it their text, study it and check up our operations against those recommended and see where we can profit. We will hold a series of meetings so we can get all the good out of these papers.

C. N. Chubb (Davenport, Ia.): From the time our prospective customer thinks of our service until we have completed that service, it resembles a chain. If any one part is weak, the chain breaks.

No matter how much care we take, how careful we are, orders do go wrong. How shall we minimize the errors? First, we must place the responsibility and try to prevent a recurrence. When an order is taken, we want to know who takes it, the clerk's initials must be on that order, he must get from the customer all the details as to what the customer wants and when that order is completed the man who signs it, showing it is completed, must show exactly what he did in every detail.

W. H. Barton (Portland, Ore.): The cause of greatest dissatisfaction in the handling of orders is delay in completion by the executing department. We have found that order scheduling solves that problem to the greatest advantage.

Our schedule is made up in conference by the superintendent of the utility bu-

reau, the sales manager and the office manager who agree that each order shall be executed within a certain time. The sheets are gotten out containing the orders and the days or hours required to complete them. Those lists are supplied the salesmen and counter clerks who are authorized to always promise that date of execution or that number of days to the customer. That schedule covers maximum, not average. The utilization bureau must in all cases execute orders according to that schedule. A customer loses a great deal of confidence in a company that does not carry out its promises in filling orders.

I do not believe that the counter clerk who books these orders should ever be permitted to take the money on deposit. He should hand the customer a deposit form with stub attached, and the customer should pay that money at the teller's window just as he would pay his bill. We have had one or two unfortunate circumstances develop by allowing the counterman to accept money. The deposit form reads that it is not an official receipt until stamped by the cashier or teller.

The clerk who books orders or applications of any kind over the telephone should be a clerk other than the counter clerk, because the counterman should always be at hand to wait on the customers the minute they come up to his counter.

J. M. Scott (Wilmington, Del.): How do you know the customer will go to the cashier's window with the stub?

W. H. Barton (Portland, Ore.): Duplicate slips are checked each day with the meter deposit record cards. If a particular duplicate shows that there is no card made out, the stub has not been received by the cashier, and we call the customer up and ask him for his deposit.

J. M. Scott (Wilmington, Del.): The trouble is, that compels the customer to make a second call due to your routine after getting service. In some manner you should make sure that the customer paid his deposit before he left, especially where your cashier's department may be on a different floor from the counter section. You send the customer to pay the deposit and, unless you have some way of sending it through a carrier or send it by messenger, you do not know whether the customer is going to reach the cashier's cage.

A. R. Keller (Syracuse, N. Y.): I agree with Mr. Scott. We talk about service and when a customer comes in and we send him here and there, that is not service.

When a customer comes to our service counter, we take a final collection, we take a deposit, we do anything he wants us to do without shifting him. And it works out very satisfactorily because we do not have to shoot the customer around through the entire building. First we have the credit, then applications and then the cashier's cage, and we have our customer's complaint counter connected with this cashier's cage with a Lamson tube and we shoot the money right over to the cashier. We have kept records on this Lamson tube and we find we do not keep the customer waiting longer than three minutes on the average.

W. A. Doering (Boston, Mass.): We want to give the customer service and to do it we want as high-grade men as possible for the application counter. If that man is high grade, why is he not capable of handling money?

One time I received a very poor impression of a certain gas company office because I heard some very loud talking between the counter clerk and a customer in front. Afterwards, I found there was a good reason for that loud talking. We should have a private office for handling customers of that type so that the average customer coming into the office will not get the impression that the company is giving poor service. In fact, I would remove the complaint counter away from the application counter.

It is well to have a counter but possibly there should be a few desks around on the open floor where the customer may sit down in a chair and talk to a clerk. That gives it a more personal touch.

I do not believe in giving a temporary receipt as suggested in the report. Why not give a regular receipt when he takes the money instead of a temporary three-day receipt?

F. H. Patterson (Rochester, N. Y.): It is fundamentally wrong for any organization of any size to have its clerks, who have access to the records, receiving cash.

We place within the service department, a cage which is under the jurisdiction of the head cashier and belongs to the treasury department. When deposits are received, they are passed right into this window by the credit man, who is in close proximity, and near to that is the duplicate bill desk so that the duplicate bills will be paid at that same cage and all the cash will be received by a teller under the direction of the treasurer.

We have all the features recommended by the committee in our so-called service department. We have set aside a portion of our downstairs office in which are grouped the essential divisions of service departments, applications, complaints, the telephone board, credit man and all the necessary files. A customer's cash is received, he receives his deposit and everything is available without taking him away from the place.

I take exception to having the men do all the complaint work on foot as outlined in the report. Foot power is not the proper power to employ in adjusting complaints. I favor the Syracuse idea where, to keep the men busy, they are supplied with certain jobs like handling of poor pressure complaints. They have close contact with the shop through hourly calls on the telephone and presumably all complaints are cleaned up every day.

The Chairman: I am sorry to have to stop the discussion, but our program is quite full. I will ask Mr. Potter if he cares to close with any remarks.

O. F. Potter (Newark, N. J.): Mr. Doering and Mr. Scott have answered the question as to receiving money at the order desk rather than by the cashier. The committee's ideal was to have everything accessible at the order desk so that the customer could be served with the least demand on his time.

As to the temporary receipt, these are used in connection with the application for gas where the customer is not in the office and it is decided to obtain a deposit. The customer is notified by the company's representative who is authorized to collect the deposit and give the customer a temporary receipt, good for three days only. The deposit books are valuable records and are not taken from the office and they are the

only recognized final receipts for deposits.

The customer is not inconvenienced, particularly if he is given a stamped envelope and sends that temporary receipt into the office for exchange for a permanent receipt.

Let me emphasize again the value of close coordination of the order taking and order executing departments. One of the committee members said we should not talk about departments when we talked about this question. We will all agree that there should be no departmental lines in the sense that it is our particular duty to look after this portion only or that portion only; we are there to see that the customers get service as quickly as possible. In considering the customer's convenience, looking after the service of the company, the departmental lines are purely imaginary and should not in any sense be obstacles to the quick, prompt and positive action of the company in giving the customer service.

To that end, the company with which I am connected has created a position which we have termed "Supervisor of Customer Service" and this gentleman's particular duty is to see that the coordination of the departments in our company is good, that the work is accomplished, and that we do what we claim to do and that is give service.

The right man in that job in any company, large or small, where he may consider himself a man of no particular department but a man of the company generally, can do a great deal of good and he can eliminate little things that may have been viewed with some bias. He can accomplish just what we as companies ought to accomplish, that is, give the customer whatever services we are trying to give him as soon as possible, so that they may be revenue producers for the companies.

DISCUSSION

(High Bill Complaints)

A. L. Tossell (Chicago, Ill.): I would like to stress the point Mr. Hergesheimer brings out about complaint men visiting customers on the premises. I know of several companies that have had a great deal of success along that line of settling complaints.

Mr. Hergesheimer also calls attention to the study of complaints and their elimination. I think that should be gone into in the coming year and brought up at the next Association meeting. It has been suggested that at the next convention of the Association, a committee be named to devote its efforts to the subject of complaints and their prevention.

P. W. Menard (Boston, Mass.): The discussion of complaints is particularly interesting to me because I have had them to handle in Boston for some years. The gentleman does not handle the question from the correspondence side. I would like to know how that class of complaints is handled when the complaint is made by letter? Suppose they are unable to see the customer? In our Boston situation we have a great many apartment houses, where we are unable to see the customer when we go to investigate a complaint. We may be able to get in the premises through the janitor, and adjust the appliances if

necessary, but that has to be followed up entirely by correspondence, and that end of our business is quite heavy.

We have a great deal of difficulty in Boston with inaccurate meter reading and the sending of corrected bills. The consequent apology takes a great deal of our time and correspondence.

Ewald Haase (Milwaukee, Wis.): We follow up our complaint, after it is completely investigated, by a written report reciting all the operations taken by our inspector and the conditions that he found. That letter is not in argumentative form but merely the conveyor of information gathered in the course of the investigation. Our investigations are made by the best men we have, especially trained for that purpose and their investigations are as complete as possible.

We welcome the opportunity that a complaint offers to examine very carefully the methods of using gas as suggested in the paper. It is one of the opportunities that we have for improving the relations with the customer.

C. A. Conrad (Philadelphia, Pa.): Some years ago I had occasion to accumulate some figures on the subject of high bills, which showed that two-tenths of one per cent was the number of high bill complaints received in an office of one hundred and ten thousand accounts. And when you take two-tenths of one per cent and the fact that the customers are easily satisfied, except in very rare cases, the thought has occurred to me—what about the high bills that we never hear from but where the customer simply reduces his use of gas so far as possible because of the high bill? Should the company not employ some means to encourage high bill complaints? That thought of the high bill complaints that we do not get, is brought out more convincingly due to the fact of the large number of house-test orders that we issue month by month that come back to us, "burner-test O. K." showing a decided reduction in the consumption through a large number of those complaints.

J. M. Scott (Wilmington, Del.): Probably we do have a nightmare about high bills, but the difficulty is that a large portion of those who make complaints about high bills come to the office and it is not the party you are dealing with, but the number of people who are standing around and hear the complaint, unless you take these people with complaints away to your special service department to talk to. We have found that unless you do that, people who have been very well satisfied with the service would be led to think there was something wrong and make a complaint.

And then there is another point: The gentleman from Boston spoke of follow-up. We have found, where I am, that if this specially trained man, who is generally a shop man of many years' experience, reports back to the service department where the complaint originates, then, of course, they can check the work to see that it is taken care of and they can follow it up by a letter if necessary.

Ewald Haase (Milwaukee, Wis.): We have for many years issued periodically a card asking consumers if they will not report any imperfect service. The card is so arranged that some of these imperfections are enumerated. While we do not have a line there asking about their gas bills, whether they are too high, there is a blank line for general remarks and we get quite a few returns in that way. It seems to me that

this brings about just the desired action on the part of those who otherwise would not bring in their complaints. We follow them up in that way.

G. H. Albrecht (Baltimore, Md.): We have had the same experience of bringing up a number of complaints of customers who have kept quiet in the ordinary sense of the word; that is they did not tell us anything. And in sending out these cards, we have drawn a number of those complaints out and have been able to investigate them and satisfy the customers.

T. A. Schlink (Peoria, Ill.): Before the bills are sent out, they are compared with the customer's record to see whether the bill is high or low. If the bill is high or low, a slip is made out and turned over to the inspection department and approximately two days after the meter has been read, the inspector goes back over the customer's premises and investigates that bill. The inspector finds out whether the high bill is correct or not before the final bill is sent out to the customer. In that way we find a great many complaints are eliminated, because the customer, if his bill is high and is correct, knows about it before he gets it. Incidentally, on the low side, we find a lot of meters that are stopped and are able to send an estimated bill for the period giving us a revenue which otherwise would be lost. That has worked out very satisfactorily with us. I pass it on for your information.

F. W. Crowley (New Bedford, Mass.): Our company uses the same policy as the last gentleman spoke about. We find it works out to very good advantage.

C. M. Finnegan (St. Joseph, Mo.): In supplementing the remarks of the two gentlemen who just preceded me, we make an investigation of low bills and conditions with the idea of seeing whether the meter was under-read, because an under-read meter makes a high bill the next month and you can not talk the customer out of it.

S. E. Linton (Nashville, Tenn.): We have found it very helpful to follow the practice of comparing the consumption with previous months, because usually the record will show that a person's gas bill ordinarily does not greatly vary. We follow that practice and as soon as we find a reading is out of line one way or another, before the bill is sent out, an inspector is sent out to check it up, or a competent meter reader who can check it up very carefully and get some information that will be helpful to us and helpful to the consumer.

Another point covered by one of the speakers was that of sending out cards to find out from the consumer if his appliances are working satisfactorily or if his service is satisfactory. I have tried that for a number of years and I have found that there is not one consumer out of ten who knows whether his appliances are in good condition or not.

We have found the best system to give good service to the customers is to have inspectors go from house to house and make examinations of appliances.

W. F. Boyd (Philadelphia, Pa.): I think that the personnel is a big factor in taking care of high bill complaints. Changing meters does not give satisfaction to the customer; it is apt to lead to further requests to change meters. I have noticed that generally when an employee of sufficient experience and intelligence takes care of a high bill complaint, it is either satisfactorily explained or adjusted.

J. M. Scott (Wilmington, Del.): My experience with one situation that I visited was that the appliances were installed by workmen who worked directly under the commercial department and the orders were not received at the regular distribution department, but the matter was handled right under the commercial department. If there was anything wrong having jurisdiction over it, they could take care of it. If the man working on high bills reports back to your service department, why should not those complaints on appliances installed be reported directly back to the new business department, who installed them and who should have supervision over the man making the inspection, instead of going through the distribution department?

DeWitt Clinton (Worcester, Mass.): We have found in Worcester that the complaint meter or recording meter is one of the easiest ways to answer a high bill complaint. We have used it there with great success. It is prima facie evidence, if your customer will play fair with you, and I believe that nine hundred and ninety-nine of our customers out of one thousand, and an even greater percentage than that, will play fair with you if you play fair with them. They will not cut out the burning of gas just to have that complaint meter show a lower consumption.

There is one other thing that I want to call to your attention and that is the accuracy of the meter. Our Public Service Commission of Massachusetts, in their engineering department, put out a pamphlet on the accuracy of the meter. They plainly told the people that most of the complaints were erroneous, that the gas was really consumed if the meter was read correctly. They put the dials on this little pamphlet and asked the people to read their own meters and they would find the meter was an accurate machine, as accurate as their watches.

W. A. Doering (Boston, Mass.): I think we have heard a lot about reading of meters forestalling high bill complaints. But there is one point which has not been touched upon and that is the over-zealous salesman who goes out and tries to sell an appliance, telling the person that it will cost him so much per day or so much per hour and it will only consume so many thousand feet in the course of a month, or something like that. I think that is a point that should be taken up by the sales department. Eliminate such statements and thereby eliminate a lot of high bill complaints.

G. M. Hergesheimer (Philadelphia, Pa.): In summing up, it might have been well if I had prefaced the reading of this paper by stating that the committee recognized that they had not covered the question of correspondence. There was to be twenty minutes devoted to this subject and the committee realized that they could not entirely do justice to the subject of correspondence in that limited time. They, therefore, reported back to the major committee, and it was decided that the question of correspondence would be treated in another paper or else covered next year.

It was also decided at that time that the question of non-registering meters and the question of low bills would come up, or rather that the question of low bills and non-registering meters be treated in another paper at a future time.

Answering Mr. Scott, the committee, I believe, were of the opinion that the high bill man should report to the service department and the service depart-

ment issue the necessary orders on the distribution department for any adjustment of appliances, but in no instance for the distribution department to handle the high bill man.

The Chairman: Mr. Tossell, have you anything to say in a general closing of the entire report?

A. L. Tossell (Chicago, Ill.): The committee realized when they tackled the job that it was a very large one, broad in scope, and could not possibly be covered in a single report. I think that the incoming management of the section has in mind, possibly, the continuing of the report.

The Chairman: We will now hear the report on Budgetary Control.

REPORT OF THE BUDGET COMMITTEE

F. H. Patterson, *Chairman,* Rochester, N. Y.

Introduction

A Budget System should be an essential feature of every well regulated organization. It furnishes for the management a forecast of activities and a control over expenditures.

Budget making falls logically into four separate divisions:

Construction
Operating
Materials and Supplies
Cash

For this reason the report of the Budget Committee is divided under these captions, separate sub-committees having dealt with each subject. Each section is designed to be complete in itself so there is little to be stated of a specific nature in this introduction.

These general aspects of the subject are worthy of note however.

Budgets may be of the term or continuous type, the former being for a definite period, for example, the calendar year of six months, while the latter is a continuous record in which new activities are added and those completed dropped.

The method employed in Budget making and administration is dependent upon the size and organization of the company concerned. The general plan productive of the best results may be outlined as follows:

The forecasts are prepared by the departments concerned and forwarded to a budget officer or committee closely allied with the management. The data furnished is assembled into a complete budget. The more important projects may have to be authorized by the Board of Directors in addition to the management. When all formalities have been complied with and such revisions made as may be required by the management the statement becomes the official budget for the period. Thereafter, during its term, the budget officer or committee should furnish each department periodically a statement of the actual costs in comparison with its forecast. These statements of all departments would also be reviewed by the management.

The educational benefits to all who participate in the preparation of the budget is obvious, while the standards set up stimulate department heads to keep within the record. A budget, however inaccurately prepared, is better than no budget at all. Even an inaccurate budget represents a plan and continued experience in budgeting will result in better planning and in more efficient and intelligent outlook into the future, bringing closer cooperation of all departments with each other and resulting in better and more efficient and, over a long period, cheaper service to the public.

In the preparation of this report acknowledgment is made of the courteous co-operation rendered by Mr. D. W. Harris, chairman of the Budget Committee of The National Electric Light Association, especially for permission to use that Committee's Report read at the Convention of 1922 and from which much information on this subject was derived.

There follow in order the reports of the sub-committees on Construction, Operating, Materials and Supplies, and Cash Budgets.

CONSTRUCTION BUDGET

H. C. Davidson, New York, N. Y.

Budgetary control is particularly important to a public utility in respect of its construction expenditures. Its investment in additions and extensions usually originates primarily from necessity to ensure uninterrupted service and meet a larger demand upon its service. It cannot defer the enlargement of its plant until financial conditions may be favorable or increased profits are assured from the additional investment. The coordination between the commitments for construction expenditures and the ability to finance these additions under favorable conditions is therefore an essential part of its financial management.

The construction budget provides an effective means of accomplishing this coordination by a standardized routine. Its object may be broadly defined as:

(1) To ensure a well balanced and carefully planned construction program.
(2) To provide a basis of centralized executive control over expenditures for plant and property, and
(3) To furnish the executives with a forecast of the proposed construction outlay sufficiently in advance of the actual requirements to permit adequate planning of necessary financing.

Presumably no company can continue the policy of expansion indefinitely without involving the necessity of interesting additional capital in some form, and we believe every company has a budgetary program to a greater or lesser degree. It may consist merely of informal estimates not rounded into a comprehensive plan, but the same fundamentals exist. It is hardly necessary, therefore, to enter into a detailed discussion of the advantage of the formal budget, and consideration of the subject is directed primarily to a suggested procedure for a definite program.

The elaborateness of the program will depend upon the conditions of the individual company. In a small company where the executive may be in intimate contact with the details of the plant, the program may be agreed upon practically without the necessity of formal records, whereas the same result in the larger companies may require inter-departmental records and a regular routine. Physical conditions may also affect the routine necessary. More complete reports, for instance, will be required by a company whose executive offices are located at a distance from the actual operations than by one whose executives are within immediate access to the original details.

A budget may cover a definite period, for which the period of a year is recommended for the construction budget, or may be continuous, providing for a uniform period in advance by the addition of a month to the forecast as each month is passed and dropped from the schedule. The continuous budget has the advantage of a definite program at all times for, say, a year in advance, but construction plans

do not lend themselves as satisfactorily to piecemeal consideration of plant additions as in the case of a forecast of operations, particularly in localities where the construction is seasonal and large projects are usually undertaken as far as possible under the more favorable conditions of the summer months.

The annual budget necessarily accumulates a certain amount of deadwood before the end of the year, but on the other hand affords a more definite comparison progressively during the year between the forecast and actual expenditures. It likewise may become incomplete before the end of the year, by the changes in plans or conditions which could not have been foreseen at the time of its preparation, and quarterly consideration is recommended whether the annual or continuous budget is adopted. In the one case for action upon such additions as may have become necessary since its adoption, and in the other for the inclusion of the additional quarterly period. The annual budget is discussed in the procedure outlined below as the routine is substantially the same under either method.

The initial step in the procedure of preparation of the construction budget is a report from each Operating Superintendent to the Chief Engineer or proper executive, containing recommendations of the ordinary extensions and additions needed, each project being reported upon a separate sheet for individual consideration. Thus the operating engineers become an integral part of the organization in the consideration of plant additions. These reports should include also items of major repairs, as action upon proposed construction may be directly affected by the policy adopted in connection with changes to existing plant, or a single project may involve both alterations and new construction. Such reports should be made from time to time as the need arises, but for the annual budget system complete recommendations should be made at least two or three months prior to the beginning of the year.

These recommendations should be passed upon first by the Chief Engineer, and have his approval before the preparation of estimates of the cost of the work contemplated. In fact, the departmental reports may be considered merely tentative suggestions for his guidance as a preliminary survey to be revised, amplified or disapproved according to his judgment. Alternate plans as to the same project may also be submitted for estimates, for final decision after the comparative costs are known. When material changes in the program are made, it is recommended that the Superintendent in question participate in such decision, that he may be entirely familiar with the revised plans for his department.

Items representing major extensions to provide for the anticipated growth of the company, or expansion of its activities, will probably originate with the Chief Executive, and will require estimates by the new Business Manager of the volume of sales for several years in advance, and the recommendations of the engineers as to the most desirable type and location of the additional facilities.

For the purpose of the budget, "round figure" estimates are usually made, as too much time would be required for detailed plans and exact quotations. Attempt should be made, however, to determine as accurately as possible by short-cut methods the estimated cost, in order that the budget may be of the greatest value.

When estimates have been made of the costs of the various projects tentatively considered, the data is ready for the for-

mulation of the final construction program to be submitted for approval. The procedure at this point will depend upon the manner in which a company is organized. The preparation of the budget may be made by the Budget Committee itself, or may be made by the construction engineers acting either as a formal sub-committee or by informal conference.

Two distinct functions, however, enter into the preparation of a budget:

ANNUAL BUDGET, 19____. Authorization No.__________

______________________Company

____

Budget Reference No.__________ Project No.__________ Class Imperative / Desirable

DETAILS OF PROJECT

Location

Description of Project

Purpose and Necessity

Estimated Period of Construction From__________19____To__________19____

Estimated Total Cost $__________

Final Cost $__________

____

Approved: ______________________

Form A—Actual Size 8½" x 11"

(1) The physical construction needs for increased facilities or economies of operation, for which the construction engineers are best qualified to make recommendations unhampered, and
(2) Consideration of these needs in the light of financial conditions or in connection with the general policies of the company.

Whatever the form of a company's organization, the budget as originally drafted should, in the writer's opinion, represent the former, to be subject to revision as may be required before final adoption

It is immaterial whether the Budget Committee fulfill the one function and the Board of Directors the other, or the Budget Committee assign the former function to the engineering staff and reserve its approval to the final program which it may ask the Board to authorize.

It is the usual practice to group the budget projects recommended according to the urgency of the work, for which the classifications of (1) Imperative, and (2) Desirable, appear to have been most commonly adopted. Some companies subdivide the projects in greater detail according to the urgency or purpose of the construction, but it is believed that the two classes above will serve all ordinary needs for the average budget.

The budget should also include the expenditures necessary for the completion of projects authorized in prior years. Some companies re-estimate the cost of the construction remaining, revising the estimate to conform to changes in plans which may have been adopted since the original budget authorization was approved. Other companies prefer to adhere to the original budget figures, providing in the current year's budget only for the actual unexpended balances, and to report separately proposed additional expenditures arising from revision of the initial program.

Suggested forms are appended for report of each project in detail to the Budget Committee, Form A being assigned to report new work, and Form B for report of unexpended balances of prior years' authorizations. This latter form provides for explanations of substantial variations between the original estimate and the cost of the job to date in relation to the percentage completed of the total work.

An additional form may be used if desired for the original departmental recommendations, but it is believed one form will serve every purpose by using the original report as the working copy or master sheet for all papers pertaining to changes, all estimates, and other data as to the project, and by typing a copy as finally submitted for the consideration of the Budget Committee.

Summary sheets (Forms C & D) are also appended, for grouping and summarizing the individual projects finally adopted, cross reference being made to the detail sheets by serial number.

It is realized that no standard forms can be recommended which will fit the needs of all companies, and the forms submitted are offered only as a guide to be adopted to the accounting practices and revised to the nomenclature of the individual company.

The budget will be of little value unless a check is maintained upon those responsible for its execution and accountability is established for variations between the estimated expenditures and the actual costs. It is incumbent upon the Accounting Department therefore to maintain a record in some form classifying the construction costs by budget items.

The form of such a record will depend upon the accounting practices employed. If a job order system is used, the job order—or a master sheet summarizing several orders applicable to the same budget item—will serve as a convenient means of compiling the necessary data. Companies not using the construction job order system may accomplish the result by a budget record to which all entries

ANNUAL BUDGET, 19___

____________________________Company

Auth. No.________ Year of Auth.________ Budget Ref. No.________ Detail Sheet No.________

DETAIL OF UNEXPENDED BALANCE OF AN AUTHORIZATION OF A PRIOR YEAR

Location

Description of Project

Amount approved by Budget Committee		$________
Amount authorized by Executive Committee		$________
Expended to Oct. 31, 19____	$________	
Payable in November and December, 19____ (Estimated)	$	$________
Unexpended Balance December 31, 19____		$________
Status of Work under this Project		______% Completed

EXPLAIN BELOW:

1. Any variation between amount approved by Budget Committee and amount authorized by Executive Committee.
2. Overrun or underrun of amount of Executive Committee authorization if variation is greater than 10% or more than $1,000.

Signed________________

Form B—Actual Size 8½" x 11"

affecting budget items are posted. If a columnar construction ledger is used, it may be possible by the assignment of separate columns to provide automatically the budget information without additional clerical labor.

For the purpose of complete data during the progress of the work, the Construction Department may also require for its needs a record of expenditures on each budget project. This record will take into account contractual obligations

ANNUAL BUDGET, 19___ SUMMARY OF PROJECTS

___ *Company*

Reference Number	Project Number	Location	DESCRIPTION OF PROJECTS	ESTIMATED TOTAL COST Imperative	Desirable	Total
			Total of Budget for 19........			
			Unexpended Balance, Appropriations of prior years. (Details attached)			
			Total			

Form C—Actual Size 8½" x 11"

as incurred and will serve as a guide to the engineers during the construction period, and upon the completion of each project and the entry of all charges in the books should be reconciled with the Accounting Department record of the actual cost.

Some companies maintain an authorization system in addition to the budget,

ANNUAL BUDGET, 19___

________Company

SUMMARY OF UNEXPENDED BALANCES OF APPROPRIATIONS OF PRIOR YEARS

Year of Auth.	Budget Ref. No.	Detail Sheet No.	DESCRIPTION OF PROJECT	Amount of Authorization	Expended to Oct. 31, 19......	Balance Unexpended at Oct. 31, 19......	Payable in Nov. & Dec. 19...... Estimated	Payable During 19...... Estimated

Form D—Actual Size 8½" x 11"

requiring the approval of the Board of Directors or the Executive Committee for all expenditures over a certain sum or upon all construction and repair work. While this authorization may appear to be a duplication of the budget routine, the approval of the Board is not usually asked until detailed plans have been drawn and actual quotations obtained and the company is ready to go ahead with the work or let the contracts. The authorization represents, therefore, the approval of specific expenditures before the contractual obligations are incurred.

The amounts so approved by the Board may frequently differ from the budget forecast, as detailed plans may reveal the necessity of changes in type or capacity of apparatus, etc., or prices may have changed since the preparation of the budget. The budget records therefore under these conditions will require comparative statements by items, setting forth (1) the amount provided in the Budget, (2) the expenditure authorized by the Board or Executive Committee, and (3) the actual cost.

Again the existing routine will govern the method to be employed for recording these authorizations and identifying them with the budget items. Provision may be made in a budget record to include this item automatically. In the case of the budget classification in the ledger, however, a file of the transcripts of the minutes with the budget numbers entered thereon as a supplementary record may be more satisfactory.

The monthly report of budget expenditures if comparison only with the budget is involved will be simple in form. If the authorization system is combined with the budget it must provide for comparison between the actual expenditures and both the budget allowance and amount of the authorization.

Practices appear to differ as to the inclusion in the budget report of expenditures made in prior years upon projects extending into the current year. The budget itself involves only comparison with expenditures of the current year, as it includes only the unexpended balances of construction commenced in previous years. As to the Executive Committee or Board authorization, however, report may be required of the aggregate expenditure upon each authorization, in which case the amounts expended in prior years upon current projects may become a necessary part of the report.

Form E appended is designed to provide for the maximum requirements of such report, and is submitted subject to revision as to Column 6 (expenditures prior to the current year) according to the practices followed. If the figures reported in Column 5 represent only the balances unexpended as of January 1st of Executive Committee authorizations approved prior to that date, Column 6 may be eliminated. If, however, the actual amounts authorized are recorded in Column 5, Column 6 is necessary for proof of the unexpended balance remaining.

This report showing cumulatively the elapsed months of the budget period and adapted in size and form to other Accounting Department statements, is recommended as a part of its regular monthly reports. It is important also that it account for the total charges to Plant and Property during the period reported. If there be items not provided for in the budget, which by reason of their small amount may not have required authorization by the Board, such expenditures

should also be included in a separate group, in order that the total of the Budget Report may be in complete balance with the books of account.

____________________Company

BUDGET AND AUTHORIZATION REPORT

For the______Months Ended__________ ______192

PROJECT	AMOUNT OF BUDGET		AMOUNT OF AUTHORIZATION			AMOUNT EXPENDED		UNEXPENDED BALANCE		
	NO.	AMOUNT	NO.	DATE	AMOUNT	Prior to Jan 1	____ Months Ended ____	OF BUDGET	OF AUTHORIZATION	
	(Col. 1)	(Col. 2)	(Col. 3)	(Col. 4)	(Col. 5)	(Col. 6)	(Col. 7)	(Col. 8)	(Col. 9)	

Form E—Actual Size 11" x 14"

OPERATING BUDGET

Edward Porter, Philadelphia, Pa.

The Operating Budget System as outlined herein is intended primarily for the so-called small company, as the larger companies usually have budget systems in operation.

An operating budget should include the earnings, operating expenses, and income deductions.

In most companies, the manager with his immediate assistants would be best fitted to prepare the budget; the New Business Department giving assistance concerning sales, earnings, and costs of new business; the Engineering Department giving assistance as to production and distribution costs, additional plant capacity and extensions required; the Accounting Department giving assistance on commercial and general expense costs, non-operating revenue and fixed charges, and bringing the component parts together into a completed budget.

It is, of course, necessary to outline some definite program preliminary to compiling the budget, and the first step usually taken is to have the New Business Department prepare an estimate of the sales and revenue, which should give the sales in cubic feet by classes and revenue in dollars by classes; likewise an estimate of the increase in meters and services, which may be added to the company's system.

With the completion of the estimate of the sales by the New Business Department, it should be turned over to the Engineering Department to estimate upon Production and Distribution costs.

Concurrent with this estimate, the Engineering Department should prepare a Budget for construction, covering the Plant and Distribution system, which, when finally decided upon, forms the basis for estimating the amount of new capital required and for determining the amount of additional interest charges, which latter item is referred to later.

The balance of the operating costs, other than New Business costs, which should be prepared by the New Business Department, should be prepared by the Accounting Department.

As all utilities follow some form of classification of accounts, this should be the base on which to project the budget, and the Classification of Accounts of the American Gas Association is used as a guide herein.

Operating budgets are generally made to cover a year, beginning January 1st and ending December 31st; and are usually prepared in the latter part of the year preceding the budget year.

There should be shown on the Budget the complete year's operating costs of the previous year; the current period operating costs up to the date the budget is being compiled, and the current month's operating costs.

These costs should be shown in two ways, that is, the costs in dollars and in cents per thousand cubic feet for each account.

A blank form, printed and ruled, showing the accounts usually kept, should be used. Four small columns and four larger columns should be ruled off; the first to show the cost per M cubic feet, and the second to show the dollars. In the first column in each case should be inserted the costs for the preceding year. In the second column in each case should be inserted the costs for the number of months of the present year up to the time the budget is being compiled for the next year. In the third column in each case should be inserted the costs for the current month's operations. In the fourth column in each case should be inserted the estimated costs for the budget year.

Operating Revenue

The estimate of operating revenue representing revenue from the sales of gas, is best determined by the New Business Department, if such a department is a part of the organization, and in the absence of such a department, by the individuals in closest contact with business conditions in the community served and with the prospects of the growth of the company's service.

It is well to show the revenue to be obtained by classes, as called for by the classification of accounts; or if so desired, by classes of consumers, such as residential, industrial, municipal sales, street lighting and sales to other utilities.

In the preparation of this estimate, the customers already attached to the company's system and additional customers to be obtained, should be considered.

As a guide in testing the estimate, the consumption per meter or the consumption per capita, should be computed, or these factors may be used as an aid in building up the estimate.

When the estimated sales in cubic feet have been determined, the revenue in dollars should then be calculated, based upon the rates established in the rate schedule.

Non-Operating Revenue

The items to be included under this caption are usually familiar to the Accounting Department, and are generally best prepared by it.

Production Costs

The accounts for carburetted water gas production are as follows:

Production Supervision
Boiler House Labor
Generator House Labor
Purification Labor
General Labor
Boiler Fuel
Generator Fuel
Oil—Water Gas
Purification Supplies
Water
Production Supplies and Expenses
Maintenance Buildings
Maintenance Apparatus
Residuals

Production Supervision

Unless there are some changes in salaries, consulting engineers' expenses, or other items, there should be very little change in the total cost of this item for the Budget year, and a similar cost in dollars for this item should be placed in the Budget year, and this cost then divided by the estimated make to secure the cost per M of gas made.

Boiler House Labor

Unless the plant is large—and even in that event, for a small normal increase in

make, with no increase in wages, the total expenditure for this item should approximate the same from year to year. An inspection of the three columns tabulated should make it possible to estimate closely the total amount for the Budget year, after which the cost per M can be worked out and filled in.

Generator House Labor

If the make is estimated to increase, and there are no increases in rates for labor, the increased amount of gas can, to a certain extent, be made without any increase in total cost for labor, except possibly the extra cost of the gas maker and helper. This total cost, therefore, can be estimated and divided by the amount of gas made, and the per M figure obtained, which, if too low, can be increased, and the total cost increased accordingly for the Budget year.

Purification Labor

The tendency will be, other conditions being equal, that the cost per M of gas made will be about the same as it has been running in the past. An inspection of the costs already tabulated should be made, after which the estimated cost per M can be put in and the total cost in dollars for the Budget year estimated in accordance with the estimated make.

General Labor

This item is likely to be variable. If considerable construction and alterations to the plant have taken place during the past year, and a considerable amount of cleaning up and other work has been done, it may be found that the costs of that year can be reduced for the Budget year. The total cost of general labor should approximate the same each year, regardless of the usual normal increase in make. Inspection of the figures should show the total cost to be put in the Budget year, after which the cost per M can also be worked out and inserted.

Boiler Fuel

At the end of the columns, there should be filled in the amount of boiler fuel used per M, and its cost per ton, including any handling or storage charges. After securing from the Purchasing Agent, or from such other sources as may be available, the estimated price for the fuel to be used during the Budget year, an inspection of the past results obtained should make it possible to fill in the estimated amount of fuel that will be used per M of gas made, and with the estimated cost per ton of fuel, the estimated cost per M of gas made can be inserted in the Budget year, after which the total cost in dollars for the Budget year can be filled in.

Generator Fuel

At the end of the columns, there should be filled in the amount of generator fuel used per M, and its cost per ton, including any handling or storage charges. After securing from the Purchasing Agent, or from such other sources as may be available, the estimated price for the fuel to be used during the Budget year, an inspection of the past results obtained should make it possible to fill in the estimated amount of fuel that will be used per M of gas made, and with the estimated cost per ton of fuel, the estimated cost per M of gas made can be inserted in the Budget year, after which the total cost in dollars for the Budget year can be filled in.

Oil-Water Gas

At the end of the columns, there should be filled in the amount of oil used per M, and its cost per gallon, including

any handling or storage charges. After securing from the Purchasing Agent, or from such other sources as may be available, the estimated price for the oil to be used during the Budget year, an inspection of the past results obtained should make it possible to fill in the estimated amount of oil that will be used per M of gas made, and with the estimated cost per gallon of oil, the estimated cost per M of gas made can be inserted in the Budget year, after which the total cost in dollars for the Budget year can be filled in.

Purification Supplies

It is assumed that the purification stock will be changed in operating from time to time, based on experience as to the work done by the oxide. Under these circumstances, this cost should run fairly uniform per M of gas made. Then, an inspection of the cost figures in the first three columns will determine the cost to be placed in the Budget year for this item.

Water

This item should run fairly uniform in cost per M of gas made, and an inspection of the actual cost columns will determine the cost to be entered in the Budget year.

Production Supplies and Expenses

Unless there are some extraordinary items, these costs should run fairly uniform per M of gas made, and an inspection of the actual costs will determine the costs to be entered in the Budget year.

Maintenance Buildings and Maintenance Apparatus

The maintenance items will vary considerably from year to year, depending upon the condition of the plant, and on how well the plant maintenance has been kept up in the past. An inspection of the columns showing present and past costs, and a careful survey of what the probable large expenditures will be for the Budget year, will determine the figures to be entered in the Budget year.

It is assumed in making these estimates, the possibilities of reductions in costs will be considered, and these reductions included wherever they are possible or probable. This is also true of increased costs, such as large maintenance items, due to rebuilding and remodeling.

Residuals

The only residual for credit in the manufacture of water gas is usually the tar made, which may be used for boiler fuel, or sold. An inspection of the columns of cost figures, showing the present and past credits, and bearing in mind the probable use or sale during the Budget year will determine the credit to be entered in the Budget year for this item.

Production Costs for Coal Gas

If coal gas is manufactured in addition to water gas, then the estimated make will have to be divided in two, one for water gas and the other for coal gas, the amounts depending on the size of the coal gas plant and the economy of operation or manufacture of the two kinds of gases under the conditions contemplated for the Budget year. Having made this division, the water gas estimate can be made as has been indicated.

The coal gas estimate of production costs can be made in a similar manner to the production costs for water gas, except that care will have to be exercised in estimating the residual credit for by-

products, as well as to estimate as accurately as possible the cost of gas coal.

After making the two separate estimates of costs, they can be combined, and the total production costs obtained.

Distribution Costs

The following are the accounts for Distribution:

Distribution Supervision
Distribution Office Expense
Service Expense
Consumers' Premises Expense
Distribution Pumping
Maintenance of Mains
Maintenance of Services
Maintenance of Meters
Reset and Removed Meters

The costs for Distribution should run more uniformly than for Production.

The estimate of costs to be entered in the Budget year will have to be based principally on inspection of the past and present operating costs, estimating either the dollar column first, or the per M column, as may be found advisable, and whichever runs the most uniform.

If there are any extraordinary expenses, such as a consumers' inspection campaign, extensive paving program requiring overhauling of mains and services, or considerable overhauling of meters, due to repairs having accumulated, increases in these items will have to be provided in accordance with what seems probable for the Budget year. If, however, during the past and present these items have been running high, due to this work having been kept up, the future costs of these items will decrease materially.

With three periods available, it is sometimes helpful to check the total yearly costs for the Budget year by dividing the current period's costs by the number of months, and multiplying this result by 12, and also by multiplying by 12, the last month's operating cost, especially for figures that should run fairly uniform, such as the labor items, supplies and expenses, etc.

New Business Costs

The accounts appearing under this heading are as follows:

Promotion Supervision
Promotion Supplies and Expenses
Advertising
Soliciting
Appliance Demonstration

As these costs are determined largely by the company's policy, it should be possible after inspecting the costs for the previous year and the current period, to decide upon the amount which will be expended during the Budget year. If the company contemplates an extensive advertising campaign and an intensive sales campaign, it will be possible to approximate the cost of any such activities, as the cost of the newspaper advertising can readily be obtained from the newspapers and a sales campaign can be estimated.

Commercial Costs

The accounts under this heading are:

Commercial Salaries
Collection Expenses
Meter Reading
Office Expense

After reviewing the costs for the past and present periods, some idea will be obtained of how these costs are going, and in estimating for the Budget year, consideration should be given to any prospective additions to the force, any increases in salaries that may be contemplated, and any increases or decreases in connection with the expense of operating the commercial office, such as office rent,

stationery, books, office accessories, etc.

Consideration must be given to any unusual expenses that may have been incurred in the prior periods, and if they are not usual or normal, they should be eliminated in the Budget year. Under ordinary circumstances, the cost per thousand or the cost per meter may be used as a guide, but these factors should be checked with the dollar costs as well, and if the amount is insufficient or too much, it should be corrected to agree with the conditions anticipated in the Budget year.

General Costs

The accounts under this heading are:

General Salaries
General Expense
Legal Expenses
Insurance
Injuries and Damages
Uncollectible Gas Bills

The plan outlined under the heading of "Commercial Costs" will apply to "General Costs."

However, particular care should be exercised in estimating the amount applying to "General Expense," this account being more or less of a "catch all" for any expenditures which cannot be directly allocated to some particular account. Inquiries should be made to ascertain if any unusual expenditures are to be made, and which should be provided for, so that they may be included in this account, or to eliminate any unusual charges which will not have to be met during the Budget year.

It is usually a general custom with respect to the amount to be charged off for uncollectible bills, to gauge this upon past experience; a basis reflected in a certain percentage of the operating revenue or cents per thousand cubic feet, may also be used as a guide.

Accident and Damages are likewise based upon experience and the estimate for this account may be made on the basis of a certain percentage of the Operating Revenue or cents per thousand cubic feet.

The estimate for "Insurance" should be based upon the experience of the past, taking into consideration any increases or decreases in the amount of insurance to be carried, and any changes in the premium rate.

The estimate for "Legal Expenses" should be based upon the amount of actual retainers paid at the time the budget is prepared, and any anticipated expenses that may have to be provided for.

Taxes

The estimate for Taxes, covering as it does state, city and government taxes, should be prepared by basing the estimate upon the knowledge of the Company's assessment in the past, the rate and contemplated changes in any of these factors. It is well to show Taxes by classes to insure that none of the various taxes have been overlooked.

Renewals and Replacements

The amount taken up in Operating Expenses for this account will be governed by the policy or requirements of the individual companies.

Income Deductions

The present outstanding obligations, both funded and unfunded, should be set forth in detail and the interest thereon calculated. Using this result as a base, the interest on any new money which may be put into the property, whether

through the issue of securities or through loans, should be calculated from the estimated dates that interest will accrue.

These dates are usually obtained from the report covering the construction program which should state the periods during the Budget year when funds for construction purposes will be required.

Allowance should be made for such portion of construction requirements as may be financed from excess cash on hand, from estimated excess net income and from such charges in the Budget as do not require cash outlay such as Reserves, Suspense Accounts, etc.

Other income deductions, such as Rental of Leased Plants, Bond Discount and Expense, and similar items, if any, should be listed and given the proper consideration for the Budget year.

Forms

Forms F, G and H are included herein as a guide. Necessarily, any forms cannot be final, and that used in connection with the Operating Budget is a suggestion and can be built up in accordance with the requirements of each company in preparing its budget.

SHEET 1 — COMPANY — METERS IN SERVICE

	ACCOUNTS	PER M. C. F.					AMOUNT				
	GAS SALES—CUBIC FEET										
	OPERATING REVENUE										
	OPERATING EXPENSES		GAS MADE								
	PRODUCTION										
	COAL GAS										
	Production Supervision										
	Boiler House Labor										
	Retort House Labor										
	Purification Labor										
	General Labor										
	Boiler Fuel										
	Fuel Under Retorts										
	Gas Coal										
	C G Enricher										
	Purification Supplies										
	Water										
	Production Supplies and Expenses:										
	Maint Buildings:										
	Maint Apparatus:										
	Total										
	Less Residuals										
	Total Coal Gas										
	WATER GAS										
	Production Supervision										
	Boiler House Labor										
	Generator House Labor										
	Purification Labor										
	General Labor										
	Boiler Fuel										
	Generator Fuel										
	Oil (W G)										
	Purification Supplies										
	Water										
	Production Supplies and Expenses										
	Maint Buildings:										
	Maint. Apparatus:										
	Total										
	Less Residuals										
	Total Water Gas										
	Total Coal Gas and Water Gas										

Form F—Actual Size 12" x 9½"

	SHEET 2		______COMPANY
	ACCOUNTS	PER M. C. F.	AMOUNT
	DISTRIBUTION	GAS SOLD	
	Distribution Supervision		
	Distribution Office Expense		
	Service Expense		
	Consumers' Premises Expense:		
	Maintenance Mains		
	Pumping Drips		
	Maintenance Services		
	Maintenance Meters		
	Resetting and Removing Meters		
	Distribution Pumping		
	Total Distribution		
	PROMOTION		
	Promotion Supervision		
	Promotion Supplies and Expenses		
	Advertising:		
	Soliciting		
	Appliance Demonstrations:		
	Total		
	Less Profit on Appliances		
	Total Net Promotion Cost		
	COMMERCIAL		
	Commercial Salaries		
	Collection Expense		
	Meter Reading		
	Office Expense:		
	Total Commercial		

Form G—Actual Size 12″ x 9½″

	SHEET 3			______COMPANY
	ACCOUNTS		PER M. C. F.	AMOUNT
	GENERAL		GAS SOLD	
	Salaries General			
	General Office Supplies			
	General Expense			
	Legal Expense			
	Insurance			
	Injuries and Damages			
	Uncollectible Gas Bills			
	Total General			
	Taxes			
	TOTAL OPERATING EXPENSES			
	INCOME FROM OPERATIONS			
	Misc. Non-Operating Income			
	GROSS INCOME			
	Income Deductions			
	NET INCOME			
	Dividends:			
	Capital Stock			
			QUANTITY USED PER M. C. F.	PRICE PER UNIT
	Cost of Fuel Used:			
	Generator Fuel	(Per ton)		
	Boiler Fuel	(Per ton)		
	Oil	(Per gallon)		
	Gas Coal	(Per ton)		
	Water Gas Made—Cubic Feet			
	Coal Gas Made—Cubic Feet			

Form H—Actual Size 12″ 9½″

MATERIALS AND SUPPLIES BUDGET

George E. McKana, Chicago, Ill.

Materials and Supplies

This term is intended to include all of the materials and supplies required to be purchased by a gas utility in the carrying on of any of the phases of its operations. The term would, therefore, include production materials, materials required in extension of plant and equipment and incidental supplies and merchandise.

Certain of these materials are required to be continuously on hand, while others, being required for some specific purpose, need not be kept in stock at all.

It is usually most economical to buy those materials which must be kept in stock in quantities larger than will be required in any one month, in order that advantage may be taken of lower prices for larger quantities.

The need for a materials and supplies budget, however, arises here. Because of the lower prices unless some check is placed upon the purchasing and accumulation of stocks, the amount of money invested in such materials may become unreasonably large, and investment in useless stocks produces no return.

To the storekeeper falls the duty of controlling the stocks of materials so that there may be derived therefrom the economy and convenience of having the stores when required while at the same time the investment in stocks is kept as small as possible. Where there is no storekeeper this duty may fall upon the Purchasing Department, and in any case the Purchasing Department must assist the storekeeper in controlling stocks.

Use of Materials and Supplies Budget

The functions of the materials and supplies budget are:

1. To furnish the storekeeper with lists of materials and supplies required by Operating and Construction Departments.
2. To set standards as to purchases and inventories for the guidance of the Storekeeper and Purchasing Agent.
3. To assist in reduction and elimination of stocks required infrequently.
4. To present the information required by the financial officer or Budget Bureau in preparing the Financial Budget.

Term of Materials and Supplies Budget

Materials and Supplies Budgets may be either continuous or for a term.

Some companies may now have a continuous budget, but the greater number who now have budgets apparently prepare them for a term, usually one year. The procedure would be about the same in either case, so that what is spoken of herein will for convenience be a term budget for one year.

Materials and Supplies Required

In order to carry on their work effi-

ciently and economically, the Construction and Production Departments must plan their operations some time in advance of the time when they are to be begun. Usually the Construction Department will plan at the end of one year the work which will be done the succeeding year. The Production Department likewise will consider at that time its future operations. These departments should at the same time prepare estimates of materials to be used the ensuing year in their operations. While it is true perhaps, that the Construction Department may not be able to give exact lists of the materials to be required, it should be able to give some sort of list of its requirements for the guidance of the storekeeper. When these lists have been completed, even though not exact, copies should be sent at once to the officer charged with the preparation of the Materials and Supplies Budget. The Operating Department likewise should send similar lists of the materials required for its operations. Where other operations, such as Merchandise Selling and Appliance Maintenance, are carried on by the utility, lists of materials and supplies required by each department should be made up and sent to the Storekeeper and Purchasing Agent in time to permit their inclusion in the Materials and Supplies Budget. All of these estimates of quantities of materials to be used should show as nearly as possible when the material

MATERIAL ESTIMATE

Description of Work ______________ Budget

Item No. ________

The following is an estimate of the materials required for the above described work.

______________ ______________ Department

Class No.	Stock No.	Description	Unit	Quantity of Materials Required by Months												Total
		Salvage														

Form I—Actual Size 8½" x 11"

is to be required. Form I is presented as an example of the manner in which this may be set forth.

Standardization of Materials

In this connection it is desired to draw attention to the need for standardization in the types and kinds of materials requisitioned by various departments before the preparation of a Materials and Supplies Budget is attempted. It is sometimes the case that a particular type of an article is requisitioned which, to be supplied, must be purchased for the purpose, while some other type which would have served the purpose equally well, is carried in stock. This may be due to personal preference on the part of the person drawing the requisition or, more often probably, to the fact that the person drawing the requisition did not know that the one type was carried in stock. Standardization would cut down the number of materials carried in stock, prevent the accumulation in stock of materials used only occasionally and will greatly facilitate the preparation of the lists of materials called for in a Materials and Supplies Budget.

Standardization of materials suggests that the various departments requisitioning materials are to know what items are carried in stock. A stock catalogue is recommended in this connection, serving a double purpose of showing what articles are standard and which of them are carried in stock.

Preparation of Budget

When the various material lists, including those which are necessarily preliminary and incomplete, have been received by the Storekeeper, he should begin the preparation of the Materials and Supplies Budget.

It will very likely be discovered by him that no estimates have been or can be prepared as to the quantity to be used of a large number of the articles he carries in stock. It would be impracticable, for instance, in the case of a utility carrying repair parts for a large variety of stoves, for anyone to estimate the quantities of a particular part to be required in the year under consideration. It will usually be possible, however, in the case of such stocks, to determine a "low point," i.e., the minimum of such parts to be kept in stock, and to estimate for the various groups into which such supplies may be classified what the use will be during the Budgeting period.

The officer preparing the Budget then should list all of the various materials and supplies, grouping those of small importance into larger units. In separate columns he should list the quantities to be used each month as estimated by the various departments, and the quantities required to be received each month in order to keep the stock in a position to meet requisitions against it.

From this detailed estimate the totals of the "Used" and "Required to be Received" columns may be carried to a summary sheet which should show the quantity on hand at the beginning, and the book value thereof, the total estimated to be used, the total estimated required to be received. This information is then ready for the listing in further columns of any unfilled orders at the beginning, and of the unfilled orders he estimates will be on hand at the end of the period. From the figures shown it is now possible to list in a further column the quantity to be ordered and the estimated cost thereof.

This list of materials to be ordered now forms a basis of another list to be prepared by the officer preparing the

Budget which will show the estimated cash payments to be made each month for the goods to be purchased or to be received on existing unfilled orders. This list is necessary in connection with the preparation of the financial budget.

Forms J and K, herewith, illustrate the manner of presenting these figures but are not intended to be presented as models to be followed.

Approval of Budget

The lists of materials to be purchased and the list showing expected cash payments should now be submitted to the Budget Committee for its approval. After discussion, alteration and approval by the Committee, this budget should constitute a guide for the Storekeeper and Purchasing Agent.

Benefits to be Derived

Preparation of such a budget calls to the attention of those most concerned the exact present status of the investment in materials and supplies, compels consideration of the rates at which turnover thereof is effected, and assists in cutting down and invigorating the stock carried.

Reports

Regular reports, preferably monthly, comparing estimated and actual quanti-

ESTIMATE OF MATERIALS TO BE PURCHASED

First) Second) half of 12-Month Period Ending ____________ 19__

Class No.	Stock No	Description	Unit	To be Re-ceived	To be Used	To be Re-ceived	To be Used	To be Re-ceived	To be Used	To be Re-ceived	To be Used	To be Re-ceived	To be Used	To be Re-ceived	To be Used

Form J—Actual Size 8½" x 11"

ties used, quantities purchased, purchase prices and rates of turnover should be prepared and presented to the Budget Committee. The forms to be used for this purpose may be simple or elaborate, hence none is presented herewith.

STOCK ESTIMATE SUMMARY

12 Month Period Ending ____________ 19__

Class No	Stock No	Description	Unit	Mat'l. to be ordered		Unfilled Orders Beginning of Period	Unfilled Orders End of Period	Total to be Received	Total to be Used	On Hand at Beginning of Period	
				Estimated Cost	Quantity					Quantity	Book Value

Form K- Actual Size 8½" x 11"

CASH BUDGET

George E. McKana, Chicago, Ill.

A Cash Budget, otherwise called the Financial Budget, is essentially a budget prepared to show the effect upon the utility financially of the operation called for by the other budgets. Its purposes are:

1. To enable the management to take a final survey of the operations proposed.
2. To show the financial officers when, and how much, money is required to meet obligations incurred in pursuance of the other budgets.
3. To present data which may be used as a guide in the negotiation of loans or issuing of securities required in connection with financing the projects.

The Cash Budget is usually prepared by or under the direction of the financial officer of the Utility.

Term of Cash Budget

Like other budgets, the Cash Budget may be continuous or for a term. There is no essential difference in the form, information or procedure in connection with the continuous budget from that in connection with the term budget. A term budget may be for either one year or a shorter time, but if a term budget is to be prepared there is some value in using the same period for the cash budget as used for the others. By so doing, the cash budget is able to present a complete picture of the results of the operations under the other budgets whereas if it were prepared for less than the same term it could show only a part of the picture. In any case, however, revision must constantly be made, and it should be comparatively easy to prepare a cash budget on a continuous basis which would always forecast for six months or a year ahead. Unless the operating and construction budgets are also prepared for the same period, however, there will be some parts of the term in which it will not be possible to include in the cash budget any real estimate of operating and construction requirements. That is, if the cash budget is continuous, for a year's period, when the July cash budget revision is made there will be no construction estimate upon which to forecast payments in the last six months of the budget period, i.e., the first six months of the next year. However, a rough estimate may be included which will be fairly satisfactory or the cash budget may be prepared specifically omitting any allowance for construction expenditures in the last half of budget period. For convenience, a term budget will be referred to herein.

Adjustment of Construction, Operating and Materials and Supplies Budgets to Cash Basis

Before the figures presented by the other budgets can be used in a Cash Budget, they must be adjusted to a cash basis. In the case of construction, for instance, it very often happens that work for

which liability is incurred in one month will not be paid for in cash until some time thereafter. In such a case the cash budget must reflect the cash payment, not the incurring of the liability. This adjustment must be made of course by the officer preparing the budget, but the information necessary to make the adjustment will very likely have to come from the Construction Department.

current year or the following year. The cash budget must reflect the date of payment, regardless of the period in which the charge is made to Operating Expense.

Then, also, there are the adjustments due to the inclusion, in the Operating Budget, of charges for the amortization of prepaid expenses, accruals, reserves and other charges of a similar nature which, while properly included in Operating Expense, do not require the current payment of cash and hence are not to be included among cash disbursements.

Approved ______________

1922 BUDGET SUMMARY - DETAILED CASH REQUIREMENTS

ITEM	ESTIMATED COST		CHARGEABLE TO			Actual Cost to Date	Estimated Cost to Complete	Material on Hand	CASH REQUIRED		MONTHLY CASH REQUIREMENTS - 1922											
	Original	Revised	Property Additions	Reserve	Maintenance				Year 1922	After 1922	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Form L—Actual Size 8½" x 11"

In the same way there are adjustments to be made in connection with the Operating and Material and Supplies Budgets. First there are the adjustments such as that necessitated by the fact that the estimated cost of Generator Fuel and Oil to be used as shown in the Operating Budget will very likely differ from the cost of Generator Fuel and Oil required to be purchased, because of differences both in quantity and price. Taxes charged to operations in equal amounts during the twelve months are usually paid annually, semi-annually or quarterly during the

There is a third type of adjustment which must be made, this time in connection with the Materials and Supplies Budget. Duplication of items in the Materials and Supplies Budget and in either the Construction or Operating Budget must be eliminated in preparing the Cash Budget.

Preparation of Cash Budget

The financial officer, having made adjustments as required, combines the results of the Operating, Construction and Materials and Supplies Budgets and sets down as a cash budget the estimated cash receipts from each of the various sources from which they may be derived and, taking into consideration the cash on omitted unless new capital is derived from the issue of securities.

In connection with this point may be mentioned the requirement often made by regulatory bodies granting the issuance of securities that the funds derived therefrom be used for a specific purpose. If such security issues are contemplated in the budget, the estimated receipts and

ESTIMATE OF CASH RECEIPTS AND REQUIREMENTS

________________Company · By months for twelve months ending________19__

	Month of												Total Twelve Months
RESOURCES:													
Cash on hand, First of Month													
Accounts Receivable-Collections													
Notes Receivable-Public													
Dividend Collections													
Interest Collections-Public													
Interest Collections-Inter-Company													
Cash from sale of Bonds													
Cash from sale of Stock													
Sinking Fund Withdrawal													
Bank Loans													
TOTALS													
REQUIREMENTS:													
Operating Disbursements													
Taxes													
Stores													
Interest-Bonds													
Interest-Floating Debt													
Notes Payable													
Sinking Fund Deposits													
Preferred Dividends													
Common Dividends													
Property Expenditures													
Investment of Surplus Cash													
TOTAL REQUIREMENTS													
Balance													
New Money Required													
Cash on Hand End of Month													
Cash required for minimum bank balance $													

Form M

hand, determines the estimated total cash available. In the same manner he sets down the anticipated expenditures for each of the several purposes and thus determines the estimated total cash expenditures. An excess of cash receipts over cash expenditures will represent the probable increase in cash resources. An excess of expenditures over receipts will indicate that, unless the present balance is sufficiently large, some part of the proposed activities must be curtailed or disbursements on this account may be set forth separate from the main body of the budget, since the cash derived from this source will not be available for the general purposes contemplated in the budget.

Forms

Probably every company has what is effectively a cash budget, but very few companies have a specific form to be used. Usually a typewritten statement is prepared showing estimated cash re-

ceipts and disbursements and no further form is required.

The attached forms may be suggestive but are not intended to represent forms which could or would be used without alteration.

Form L is intended to illustrate the adjustments which must be made in many of the construction and operating items to bring them from the accrual basis in which form they have been included in the construction and operating budgets to the cash basis in which they must be used in the cash budget.

Form M is intended to illustrate the method of preparing a statement of the cash budget.

Reports Regarding Cash Budget

Like the other budgets the cash budget should be followed, so far as possible, and comparison should be made from month to month of the actual with the estimated results. The form for such a comparison should be practically the same as that in which the budget was prepared. It is desirable also that the cumulative estimated and actual results be compared, since ordinarily some variation of estimated and actual receipts or expenditures in each month may be expected which, over a longer period, may not exist to any noticeable extent.

Summary

The advantages to be derived from a cash budget properly prepared and closely estimated are apparent. Expenditures and receipts can be estimated very closely, and the cash budget is useful in about the same degree as the estimates are accurate. It must be admitted that some difficulty may be encountered in getting accurate estimates at the first attempt, but as time goes on the added experience in forecasting will make for very close results.

DISCUSSION

W. A. Sauer (Chicago, Ill.): The subject of budgetary control is very vital to utilities as a whole. No business can be operated successfully unless it has some method of forecasting its resources and requirements.

I have been surprised, in going around the country, to see the woeful lack of systems of accurate forecasting of requirements. Outside of the utility line I learned recently of one of the largest operating companies in this country, where the question of how much money they had or how much they would need was never thought of. They did not even have a balance sheet.

When the question of a budget was mentioned to the controller of the business, he did not know what a budget was. That is all very well when everything is running to your liking, but when conditions change, as they have many times in many businesses, a budgetary control will save many a business from going on the rocks.

That applies to the gas industry. In these days of violently fluctuating prices and costs of all description, a scientific control of your resources, forecasted as far ahead as possible, so that they have some resemblance to what the actual result may be, and a forcast of your expenditures, will save many a rate case and many criticisms from your commissioners. I could point out half a dozen instances of my own knowledge

of companies who have gone before commissions with figures hurriedly gotten together that on analysis by the commission engineers and accountants meant nothing. In one case the commission actually saved a company from incurring a loss by showing that they were not giving proper attention to their controls and finances.

The report appears to present a very complete and comprehensive plan and I think every man here should study it carefully and ask any questions he may have in his mind. I think the question is so important that I am going to make the request that those who are to assist me next year follow this matter up more thoroughly.

James Lawrence (New York, N. Y.): The report is of intense interest to me because of the very nature of the work in which I am engaged at present.

Recently I was told to give particular attention to the financing of some fourteen different companies in connection with our parent company, looking ahead into 1925, involving quite some millions of expenditures. How can we tell anything of what the requirements may be through 1924 and into 1925 unless we have some kind of budgetary control? It is most essential if we are to have the correct and intelligent idea of our businesses that we should have.

I want to lay stress on the following statements in the Construction Budget.

"Two distinct functions, however, enter into the preparation of a budget: (1) The physical construction needs for increased facilities or economies of operation, for which the construction engineers are best qualified to make recommendations unhampered, and (2) Consideration of these needs in the light of financial conditions or in connection with the general policies of the company."

It seems to me very important that we should look at this from both of these angles.

A few years ago the accounting men and engineers were far apart. Rate litigation has been a good thing in one respect, because it has brought them closer together than they have ever been before and frequently we find engineers really accountants.

Unless the engineer has some idea of what the total expenditures may be, he looks at it only from the operating engineer's viewpoint. We have found that when our engineers have completed the budget, and found that their total construction budget was to be two million dollars for the year, they have scratched their heads and said, "We can't spend that much money."

Budgetary control involves first, the cash standpoint, and second, the check on operations through the operating budget. You may think it hard to make an operating budget with the fluctuating prices of all the various things that enter into the cost of making gas. Two or three years ago I saw an operating budget made by one of our men which totaled an amount of four million dollars in earnings and at the end of that period the difference was only about seven thousand dollars from his original estimate made the early part of the year.

The cost sheets made up in connection with that evidenced weeks of study. It was a revelation to see the amount of work that had been given to that estimate made nearly a year before and the closeness with which it came to the actual results. So that I do know that these operating budgets can be made up with a fair degree of accuracy.

The materials and Supply Budget states, "To the storekeeper falls the duty of controlling the stocks of materials...." I think we have minimized the importance of the storekeeper's position. The gas man has a cinch in the matter of storekeeping compared with the electric man or traction man.

A storekeeper really worth while can save the company a great deal of money, and every public utility can give consideration to the proper type of man that they have as storekeeper. In one of our combined gas, electric and traction companies, we have saved thousands of dollars by having a high-grade, intelligent man as head storekeeper in that company.

It is suggested that there are different ways in which the cash budget can be made up. I have two striking examples in mind: One, a tabulation by months, going back for years—the disbursement of each month for the successive years shown beside each other. When it comes to making up your cash estimates, you have laid before you on that plan the disbursements during the month of January for a period, perhaps, of ten or fifteen years. You can allow for your normal increase in business; for such factors as increased or decreased construction during that month; for the increase which must be made in storeroom accounts, or perhaps, the smaller amount which you will have to expend. We have coming before us estimates made up on this basis. It is surprising how accurately those estimates are made and yet, when something occurs which throws that estimate out, we get a report that, because of this condition, the financial condition of this company two or three months from this date will be changed.

We also have them send in, based upon the need, earnings for the period with proper allowances made for deferred payments, increase in construction and other items. But our experience has been that the first plan is uniformly more accurate.

Every accounting man here can get enough out of this report on Budgetary Control to make more than worth while the expense and time involved in coming to this convention.

R. B. Grove (New York, N. Y.): It has been my privilege to be a member of the National Budget Committee of the National Electric Light Association since its organization three years ago. This year I have been honored by the chairmanship. That committee, after three years of study of the subject, presented a report to its company members setting forth what, in its opinion, were the essential features for budget preparation and administration.

We kept in mind, as Mr. Patterson emphasized, the fact that there are more small companies than large ones in our association and that it should be the aim in preparing our report to keep in mind that the small company is probably the one that will use it more, because the large company has an organization that can take care of the subject more readily.

The fundamental report has now been out two years. In order to determine whether or not we had given our member companies what they wanted, we communicated with them during this past year. Out of 289 companies of all sizes and locations there were 176 who had a budget system; 109 not having any. Of the 176 having budget systems, 149 operated a 12-month period budget, so the practice apparently seems to be a

period budget of 12 months length. There were eleven companies of the 176 who had in practice a continuous budget; the other companies varying in periods from three months to eighteen months.

The factors included in their budgets were approximately as follows: Of the 176 having budgets, 68 covered earnings, construction expenditures, operating expenditures, material, supplies, cash summary. Twenty-three included only earnings, construction expenditure and operating expenditures. Thirty-three omitted materials and supplies.

We addressed these companies first, to find out what the situation was, but primarily for the purpose of encouraging them to criticize our reports. It is difficult for a small group of men to prepare a report that would be suitable to eleven hundred central station managers.

We have not been very successful to date in obtaining criticisms, but believe that the report has not been in their hands long enough for them to really know its contents sufficiently to criticize it. The committee has been gratified, however, to be advised that twelve companies, several of them being very large central station companies, have adopted a budget system following the fundamentals laid down in our report and to date they have worked out very satisfactorily.

If you establish a budget system, it has to be sold to your organization. There will be a lot of antagonism down the line, but once sold to your men you will find that it makes a very different personnel than existed before. Besides all which your committee stated the budget control system serves, it also has that personal advantage of training your men to think in advance.

There seems to be a tendency in the last six months toward the adoption of the continuous budget, despite the figures that I quoted you. We think that that tendency will continue and will soon come into its own.

C. W. Platt (Portland, Ore.): This is the best report on the subject that has come to my attention, not even excepting the one I assisted in writing for the Pacific Coast Gas Association a year ago.

Although it would appear that we are eventually coming to the continuous form of budget, at present the senior executives of our companies prefer the twelve-months budget form. Therefore, the twelve-months budget should always list in the monthly report, or summary thereof, the completed as well as the uncompleted projects, in order that we may have a knowledge of how much of our total budget expenditures for the year on construction work in particular has been expended.

It is not of paramount importance that we have a separate stores budget; it may be merged with the operation and construction budget and often much confusion may so be avoided because the supplies which the stores department provide are all used by the construction and operating departments. Therefore, their projects may be recorded in total, including the supplies. While the accountants are the sponsors for the budget, it actually projects itself into all of the departments of the business. It becomes a very essential part of management. Our engineers prepare blueprints and specifications of the undertakings they wish to put forward. Your budget is simply the financial blueprint and specifications and, without it, you cannot hope for a complete success. In the past a budget was something to be

applied mostly to construction work. Now it applies to the every-day undertakings. It is not a thing to be laid out at the beginning of the year and referred to at the end of the year to see how we come out on it. Your engineer uses the blueprints every day and it is the same with the budget.

The purpose of an accounting department is to establish standards in the performance of work, and, if it is properly managed, it does not satisfy itself by telling us how much it costs per thousand cubic feet of gas to perform the various steps of operation.

For instance, your operating man knows that there will come up during that year a certain number of old-age meters that he must repair and he asks in his budget for an appropriation to take care of that. That information is useful to him. He can say to the superintendent of the repair men, "John, we are going to repair 20,000 meters this year. I want you to schedule that so those 20,000 meters will flow through your shop in equal amounts, month by month."

That will maintain an even amount of operating expense for the meter repair month by month. There will be no serious ups and downs to confuse management when they come down to the point of their individual income. It will also enable him to determine whether or not that meter shop is operating efficiently or not, because he has a standard cost per meter.

Your bookkeepers are able to handle so many accounts per man, and there again, you can apply a standard and you can control that day by day—the amount of money that you are spending for clerk hire.

In the matter of service and installations, it is possible for you to day by day watch the installation of these distribution facilities and to know whether in your unit cost you are standing up to the standard previously applied to that department and whether the men are performing their work efficiently.

Appliance installation jobs, which doubtless are done under work orders, have their cost, and you learn day after day as they are completed whether or not they have measured up to the standard.

The budget, it would seem, is something that indicates the rate you shall get for your gas. In the past, we have depended too much on our reports to show that we have lost money by not charging enough. After the loss has been incurred, we apply for new rates, instead of forecasting in advance, as I believe manufacturers do in other industries, to determine what rate they shall get for their product.

The Chairman: We will now have the report of the Insurance Committee.

REPORT OF THE INSURANCE COMMITTEE

J. G. Reese, *Chairman*, Baltimore, Md.

During the first two years of the activities of this committee, its work was devoted to a reduction of fire insurance rates on gas plants. The scope of the committee was extended, however, this year to embrace all forms of insurance.

The general application of the new schedule of fire insurance rates on gas properties was made during the past twelve months, and it is now apparent that the new rates have affected a considerable saving to member companies. In the September issue of the A. G. A. Monthly there were published certain statistics showing the savings obtained by twelve member companies, and the ratio of these savings to the amount of dues paid for membership in the American Gas Association. This ratio runs from 43% in one company to 585% in another. With the exception of the company having 43%, all obtained savings equivalent to their dues, and, in practically all cases, more than the amount paid. These figures are repeated here as a matter of further information:

Co.	Prem. paid Prev. to Rerating	Savings in Prem. after Rerating	An. Dues in A. G. A.	Ratio Savings to Dues
A	$9,710.00	$2,282.00	$5,174.00	43%
B	4,541.00	1,125.00	1,147.00	100%
C	3,903.00	1,142.00	533.00	220%
D	4,161.00	1,116.00	194.00	585%
E	4,723.00	798.00	420.00	190%
F	2,600.00	570.00	261.00	219%
G	1,792.00	429.00	102.00	400%
H	1,277.00	287.00	114.00	254%
I	859.00	269.00	72.00	371%
J	726.00	199.00	130.00	146%
K	879.00	161.00	101.00	160%
L	939.00	148.00	87.00	175%
		$8 526.00	$8,335.00	

Since the above information was completed word has been received of reductions obtained by several other companies, making the total amount of savings reported so far over $15,000. This amount represents actual savings reported by a very small number of company members. So few companies have reported on the subject that we feel assured the sum quoted represents but a small part of the actual savings obtained.

It seems proper at this time to emphasize the value of membership in the Association, because, if the work of one committee produces such tangible results, it is not unlikely that other com-

mittees are doing even more valuable work, which benefits member companies equally as well. The committee feels that further reductions are still obtainable, inasmuch as the loss ratio for the year 1922 was very low. Member companies, therefore, are earnestly requested to furnish insurance statistics as carefully and fully as can be obtained, in order that a strong case, for still lower rates, may be presented to the insurance interests at the proper time.

According to information from the Central Traction and Lighting Bureau which formulates the schedule applicable to gas plants the following rating organizations have adopted the new schedule:

Board of Fire Underwriters of Allegheny County.
Underwriters Association of the Middle Department.
New Hampshire Board of Fire Underwriters.
New York Fire Insurance Rating Organization (except New York Fire Insurance Exchange).
Philadelphia Suburban Underwriters Association.
West Virginia Inspection Bureau.
South-eastern Underwriters Association.
Arkansas Fire Prevention Bureau.
Oregon Insurance Rating Bureau.
Arizona Equitable Rating Office.
Western Union.
New Jersey Schedule Rating Office.
Board of Fire Underwriters of the Pacific.

Although the Philadelphia Fire Underwriters Association has not adopted the schedule in its entirety, a 25% reduction has been made in the old schedule and rating is based under this plan. Certain rating bureaus have not adopted the schedule but are using it as a guide. In this class are:

Association of Fire Underwriters of Baltimore City.
New England Insurance Exchange.
Boston Board of Fire Underwriters.
New York Fire Insurance Exchange.
Underwriters Association of the District of Columbia.
Insurance Association of Providence, R. I.

The schedule used in the state of Washington, although not the one formulated by the Bureau, probably produces rates as low. The state of Texas formulates its own rates and has no company-managed rating bureaus. In Kansas and Mississippi insurance is in a rather upset condition and there has been so much litigation that the companies are not in a position to attempt to file or apply the schedule.

Frequently local agents or brokers do not desire to press the adoption of this schedule because it may mean a reduction in the amount of premium they will receive, the utility then hesitates to insist upon its adoption because of certain friendly relations with these agents. If such is the case a direct appeal to the rate-making bureau by the utility or by the Insurance Committee on behalf of the utility will undoubtedly bring about the desired results.

If there are any localities where the new schedule has not produced the desired results the committee will, if requested, have the situation threshed out by the Central Traction and Lighting Bureau, the formulators of the schedule. In several instances, member companies have written to the committee, and when these individual cases have been called to the attention of the officials of this bureau, beneficial results have been obtained. The committee wishes to express publicly its appreciation of the assistance and courtesy extended to it by the President of the Bureau, Mr. H. A. Smith, and his assistants. The insurance companies have also cooperated

in an endeavor to have the various local rating organizations adopt the schedule as quickly as practicable. The officials of the insurance companies have been eminently fair, and as the insurance companies and the utilities have many interests in common, close cooperation will be of mutual benefit.

The committee again desires to bring to the attention of the member companies the new explosion clause which may now be attached to policies covering gas plants. Under this clause the ignition of gas resulting in an explosion is regarded as a fire, and the resultant damage should be treated as a fire loss, and re-imbursement obtained from the insurance companies. The explosion clause formulated by the Bureau is as follows:

Inherent Explosion Clause

"In consideration of the rate at which this policy is written, this insurance shall cover any direct loss or damage to the property insured hereunder caused by explosion resulting from the hazards incident to the business as conducted therein and occurring in the structure (or structures) or containing the property insured hereunder, not exceeding the sum insured, nor the interest of the insured in the property, and subject in all other respects to the terms and conditions of this policy. If there shall be any other insurance on said property, this company shall be liable only pro rata with such other insurance for any direct loss by explosion, whether such other insurance be against loss by explosion or not.

"Liability is excluded for loss or damage occasioned by or incident to the explosion or rupture of steam boilers and (or) fly wheels and their connections."

This clause has not been adopted generally throughout the country as there are some states in which laws operate against its use to a certain extent. However, it is believed that practically every company may obtain this clause or the one quoted below:

"It is expressly understood and agreed that, in construing the terms and conditions of this policy, the ignition of gas in or about the premises described herein shall be regarded as 'fire' and the loss resulting therefrom shall be adjusted and paid in the same manner as if otherwise occasioned and also that all conditions contained in other paragraphs hereof restricting the generating of gas and storage and use of naphtha and fuel oil and other inflammable or explosive materials are hereby waived."

The value of the explosion clause has not been fully appreciated, and members should see that it is made a part of their policies. If not already on the policies, brokers or agents should be requested to endorse it thereon. The committee will be glad to furnish any information desired regarding it, and will cooperate with member companies to obtain either of these clauses.

As one of the main requisites of the gas utility is continuity of service, prevention of fires, and protection against the consequent disruption of service, should be one of the chief aims of the industry. As an aid to the proper maintenance and protection of gas plants, the committee has spent considerable time in preparing a self-inspection blank for the use of plant managers or superintendents. A few copies of this form are available now, and if there is a demand for it, Association headquarters will have it printed and distribute, at cost, as many copies as are requested. This blank will be found useful in pointing out conditions which have caused fires in the past, and which, if found in any plant, may cause a serious fire, and the inevitable interruption of service.

The record of fire losses in the gas industry has been uniformly low and

based on this favorable condition the rate reduction was obtained. In order to maintain these low rates and possibly obtain a still further reduction, to which it is felt the industry is entitled, a continued and active interest in fire prevention and fire protection is absolutely necessary. This desire to prevent fire losses should manifest itself in building construction approaching nearer to the standards as approved by the Underwriters and a continued attempt to improve present physical conditions. A careful study of the inspection blank provided by the committee and the enforcement of the regulations set forth will undoubtedly bring about considerable reduction of fire hazard.

The committee this year has devoted considerable time to the study of rates for workmens' compensation and public liability insurance in the gas industry. Preliminary information obtained as to the ratio of loss to premium has justified us in requesting the bureau formulating these rates to consider a reduction. It was hoped that the necessity of a questionnaire to member companies seeking information necessary to present our case would not be required. As the insurance companies must be convinced by actual figures it will probably be found necessary to obtain this information. In view of the saving to be obtained it will be of benefit to all members if such a questionnaire is returned promptly and with complete information if sent out. The committee regrets that such a step is necessary, but has no other means of obtaining the desired data. Compiling the resultant statistics is difficult, and the committee is also desirous of avoiding the use of the questionnaire.

The attention of members is directed to a new form of insurance, which has recently appeared, known as property damage. By means of it, liability for damage to property of others may be covered. Little information is as yet obtainable regarding it, but it is intended to cover, it is believed, such disasters as the recent explosion in Springfield, in which neighboring property was considerably damaged. A study of this form of insurance will be part of the program for next year's committee.

Your committee earnestly recommends that member companies give more serious thought to insurance in its many forms. It has been noted that the best results in reduction of insurance costs, prevention of losses, and protection of stockholders' investments are attained by those companies whose insurance affairs are under the direct supervision of an executive. A thorough study of the insurance conditions in a company will not only produce savings, but will provide against casualties and losses, and the consequent irritation of disrupted service.

As the protection of valuable records is of vital interest to all and especially to the accountant, the committee directs attention to the very excellent report of the Committee on Preservation and Destruction of Records of the Accounting Section of the National Electric Light Association. The absolute necessity for properly safeguarding all essential records is stressed. Expert fire protection engineering advice obtained from outside sources is presented, explaining the best methods of safeguarding valuable records. Those who have not read this report are urged to study it carefully, and follow its advice. Some recent fires have impressed upon the minds of many how irreparable a loss may occur where records are not properly safeguarded.

SELF INSPECTION BLANK FOR GAS PLANTS

Prepared by the Insurance Committee of the American Gas Association

This form may be used as a weekly or monthly report by a trained inspector, or a foreman.

Place a check mark opposite the item, and in the column of the respective location, where there is violation of fire prevention practices as indicated.

	Location			
1. *Combustible Material*				
a Needless combustible material in any form				
b Needless accumulation of oil or tar				
2. *Clean Waste*				
a Main supply not in bin				
b Local supplies not in cans				
3. *Oily Waste*				
a Not kept in approved self-closing cans				
b Cans or lids defective				
c Cans not emptied regularly				
4. *Refuse and Sweeping*				
a Needless accumulation				
b Not gathered into cans				
c Cans not emptied regularly				
5. *Lockers and Cupboards*				
a Not clean				
b Clothes not hung				
c Material piled on top				
6. *Gasoline, Benzine, Oils and Paint*				
a More than day's supply in main buildings				
b Main supply not kept in outside storage				
c Not returned to outside storage when not in use				
d Drip pans not provided				
e Unnecessary containers open				

Location

f Empty containers allowed to accumulate

g Safety cans not used for volatiles

7. *Matches and Smoking*

a Safety matches not used

b Smoking in prohibited sections

c "No Smoking" signs not posted or defective

8. *Heat Hazards*

a Steam pipes, stacks, furnaces, stoves or ashes in contact with or exposing combustible material

b Stacks—less than 18″ clearance when passing through wooden floors or roof. (12″ clearance permitted if with ventilated metal collar)

c Stoves—No metal guards

9. *Gas Hazards*

a Brackets near combustible material (Swinging brackets especially hazardous)

b Open flame burners liable to cause explosion of gas (Special hazard of purifier, meter, condenser, blower, oil and pump rooms)

c Stationery appliances not permanently connected

d Hose of portable appliances defective

10. *Fire Doors, Traps, etc.*

a Do not operate freely

b Obstructed

c Blocked open

d Not kept closed where possible

e Bearings not greased

f Fusible links not properly placed

g Hardware defective

h Doors not painted (Do not paint links)

Location

11. *Fire Spread*
    - a Broken window panes, plaster, floors, etc.
    - b Unnecessary concealed spaces
    - c Openings not screened against sparks
    - d Shutters defective
    - e Shutters not closed at night
12. *Water Barrels and Pails, Sand Pails*
    - a Missing or not provided where desirable
    - b Access obstructed
    - c Not full
    - d Water frozen
    - e Sand not fine, clean and dry
    - f Scoop not provided for sand
    - g Not painted
13. *Chemical Extinguishers*
    - a Missing or not provided where desirable
    - b Not hung in accessible place
    - c No tag showing date charged
    - d Not discharged & recharged during year
    - e Not protected against freezing
    - f Discharge orifice, hose or nozzle clogged
    - g Hose deteriorated
    - h Tetrachloride extinguishers not full
    - i No extra charges in stock
14. *Inside Hose Outfits*
    - a Not provided where desirable
    - b Access obstructed
    - c Hose not connected or racked
    - d Drips not open or valve leaking
    - e Water in hose
    - f Nozzle missing
    - g Frozen or otherwise defective
15. *Outside Hose Outfits*
    - a Insufficient number or improper location
    - b Not connected or racked
    - c Not given pressure test twice yearly
    - d Not dried after use

Location

16. *Hydrants and Hydrant Houses*
  a Access obstructed
  b Hydrants do not open freely (Do not test in winter)
  c Do not drain properly or leaking
  d Not protected against freezing
  e Hydrant house not in good condition
  f Doors of house obstructed
  g Equipment of hydrant house not complete, viz: Play pipe, spanners, gaskets, axe, hydrant wrenches, crow-bar, lanterns trimmed and filled, matches

17. *Private and Public Alarm*
  a Access obstructed
  b Not regularly tested
  c Cards not posted with instructions for use of private alarm or location of public alarm box and keys and what to do in case of fire

18. *Maintenance*
  a Fire drills not held
  b Ladders not in place
  c Ladders defective
  d Watchman's clock record not checked regularly

19. *Fire Pumps*
  a Pump started until discharged through relief valve?
  b Steam pressure...... Pump clean and well oiled?
  c All valves in steam connection wide open except at pump?
  d Date of last test with hose ....

20. *Oil and Tar Tanks*
  a No turned down screened vent
  b Manholes not covered
  c No permanent connection for filling

	Location			
d Sounding opening not kept closed				
e Wooden or loosely fitting metal roofs				
f Dikes not provided				
g Not protected against lightning				
h Gauging with metal rod (use wooden pole)				
21. *Oil and Tar Receptacles, Separators, etc.*				
a Not covered				
b On wooden supports				
22. *Oil Systems*				
a No shut-off valves				
b No pressure relief valve				
c No drain for overflow				
23. *Oil and Tar Pumps*				
a Not in incombustible building cut off from other buildings				
24. *Used Oxide*				
a In contact with combustible material				
25. *Garages*				
a Storage of gasoline not standard				
b Filling equipment not grounded to prevent static				
c Gasoline used for cleaning parts (use kerosene)				
d Repair pits not clean				
e "No Smoking" rule not enforced				
f Electrical installation not standard				
g Hazard from torches, open flame burners, etc.				
26. *Drum Filling*				
a Equipment not grounded to prevent static				
27. *Tank Cars*				
a Openings not covered				
b Vent not provided				
c "No Smoking" rule not enforced				
28. *Meter Repair Shop*				
a Drip from meters not removed daily				

Location

b Soldering furnaces not piped
c Soldering furnaces or pots on unprotected woodwork
d Work benches not clean and space underneath not clear
e Waste or rags in bench drawers
f Meters not capped when tested with gas

29. *Purifier and Condenser Houses*
  a "No Smoking" rule not enforced
  b Open flame lights not protected
  c Electric installation not standard

30. *Construction Work*
  a Hazard presented from
    1. Lumber piles
    2. Use of lanterns
    3. Stoves in shanties
    4. From any other source

31. *Electrical Installations* in manufacturing sections, such as purifier, meter, blower, oxide revivifying, oil and pump rooms, and garages, where ignition of gas or vapor is liable to occur should be in metal conduits, vapor-proof globes, keyless sockets, with controls located outside of building. Is this standard maintained? ....

32. *Wiring*
  a Defective insulation
  b Not properly supported
  c Not in conduits
  d Conduit outlets not bushed
  e Conduits not grounded
  f Grounded to gas piping
  g Connections not soldered and taped
  h Solid wires for portable use
  i Liable to mechanical injury
  i Temporary wiring
  k Circuits overloaded
  l Vapor-proof globes not provided

Location

33. *Fixtures*
    - a Loose connections
    - b Shells loose or missing
    - c Otherwise defective
34. *Pendant Lights and Extension Cords*
    - a Defective insulation
    - b Improperly supported
    - c Cords not reinforced type
    - d In contact with piping
    - e Tied aside
    - f Adjusters needed
35. *Lamp Guards and Shades*
    - a Shades of combustible material
    - b Guards not provided where liability of contact with combustible material
    - c Defective
36. *Fuses*
    - a Link of mica capped fuses not enclosed
    - b Bridged with wire
    - c Circuits too high
    - d No extra fuses on hand
    - e Located inside manufacturing buildings
37. *Switches and Circuit Breakers*
    - a Liable to mechanical injury
    - b Loose connections
    - c Defective, not indicating or blocked
    - d Near combustible material
    - e Wooden cabinets not lined
    - f Voltage release set too high
    - g Cabinet door not closed
    - h Located inside manufacturing buildings
38. *Rheostats, Motors, Resistances*
    - a Rheostats not protected
    - b Rheostats mounted on wood
    - c Blocked in running position
    - d Do not release properly
    - e Excessive sparking of motor
    - f Motor liable to cause explosion of vapor
    - g Near combustible material
    - h Contacts defective

The next order of business was the report of the Committee on Uniform Classification of Accounts.

REPORT OF THE COMMITTEE ON UNIFORM CLASSIFICATION OF ACCOUNTS AND FORM OF ANNUAL REPORTS TO COMMISSIONS

W. J. Meyers, *Chairman,* New York, N. Y.

The work of this committee during the past year has consisted of promoting the adoption of the uniform classification of accounts developed through the joint efforts of the American Gas Association, the National Electric Light Association and the National Association of Railway and Utilities Commissioners. The Electric Light Association deemed it advisable to propose certain amendments to the 1920 Commissioners' Uniform Classification for electrical corporations. Some of those proposed amendments, affecting the fixed capital accounts and the operating expense accounts for electrical corporations were substantial, but inasmuch as they involved no principle affecting gas corporations this committee took no stand toward them. Others, principally one affecting the Retirement Reserve and the Retirement Expense accounts, were revisions of verbiage designed to clarify the text, and as they involved no change in principle, this committee concurred in them in the joint conference with representatives of the other two associations above mentioned. Other changes making provision for a greater inclusion of minor rents in operating expenses and for a simplification of the tax accounts were in line with previous recommendations of this committee, and we took advantage of a renewal of discussion of them to urge again the adoption of our views on these matters. In this we were successful, and our recommendations were accepted by the committee on statistics and accounts of utilities in the commissioners' association. That association at its annual meeting held in Detroit last November accepted the recommendations of its committee aforesaid and authorized the proposed changes in its Uniform Classification of Accounts for Gas Utilities. Its classification as thus revised (1922) has since been accepted by the Executive Board of the American Gas Association as the official classification for our association.

At the conference held last November with the commissioners' association committee on statistics and accounts of utilities, we submitted a proposed form for annual reports of gas corporations to state public service commissions. Our proposed form consists of sixteen pages and is based on the commissioners' Uniform Classification of Accounts for Gas Utilities. It includes provision also for such additional matters of plant and operating statistics as we think to be of sufficient importance and general interest to warrant their inclusion in annual reports. The commissioners' committee wished to give our

propositions a more careful consideration than they found practicable before the presentation of their report at Detroit, and therefore, held the question open for further discussion. Arrangements have been made for a conference with that committee next week, the results of which will be reflected in its report to be presented at the convention of its association next December.

During the past year, various members of this committee have appeared before representatives of several state commissions and urged the adoption of the commissioners' classification. A good degree of success has attended our efforts, and we are hopeful of further success along this line in the near future. The list of states whose commissions have adopted the commissioners' Uniform Classification of Accounts for Gas Utilities includes the twelve above named:

Alabama	Colorado
Illinois	Indiana
Massachusetts	Michigan
Nevada	North Dakota
Tennessee	Utah
Virginia	Wisconsin

The classification is receiving careful and sympathetic consideration in several other states.

The committee recommends that for the next year its work be continued along the same lines, and that as soon as the commissioners' association adopts a standard form for annual reports of gas corporations to state public service commissions acceptable to the American Gas Association, the committee have as a part of its duties the presentation of such form to tax and other commissions requiring annual reports from gas corporations with the purpose of securing its adoption by such commissions.

(Upon motion duly made, seconded and carried the report of the committee was accepted and ordered printed in the Proceedings.)

The Chairman: Mr. Davidson, yesterday afternoon you were elected Vice-Chairman of this section for the ensuing year. Mr. Sauer was elected Chairman. Unfortunately you could not be here. It affords me a great deal of pleasure to advise you of your unanimous election and I am sure that your friends will be very glad to hear of your acceptance.

H. C. Davidson (New York, N. Y.): This is the first notification I have had of the action that has been taken. Generally speaking, I think when a man enters or undertakes responsibility it is not exactly the time for him to have very much to say, particularly when it is responsibility for the future. Besides, the hour is pretty late, so I am going to confine myself to just one thing.

I have been very deeply interested in the work of the Association and have gotten a great deal of benefit and information from it. I want to thank you, gentlemen, and assure you that I will give my best efforts and full cooperation with Mr. Sauer to assist him in every way within my power to keep up and maintain the high standard of work which has been maintained by the Accounting Section during the last three years.

The Chairman: I am sure, Mr. Davidson, the section is to be congratulated upon having such very capable officers for the ensuing year, and also the gentlemen themselves are to be congratulated upon their selection.

ADJOURNMENT

THIRD SESSION

Thursday Afternoon, October 18, 1923.

REPORT OF THE COMMITTEE ON FIXED CAPITAL RECORDS

H. J. LaWall, *Chairman,* Philadelphia, Pa.

The Committee on Fixed Capital Records for 1923 was organized in the fall of 1922, being a continuation of the committee first organized in 1921 under the name of "Committee on Continuous Inventory of Fixed Capital."

Preceding Committees

The 1921 Committee made a canvass of the larger member-companies to ascertain the method in use for keeping detailed construction records and to learn the attitude of these companies toward maintaining a Continuous Inventory of Fixed Capital.

The 1922 Committee made a further study of the subject, covering the definition and advantages of maintaining a continuous inventory and presented a general outline for installing a workable system.

Outline of Work for Year 1923

At the first meeting held in New York City in December, 1922, the Committee outlined the work to be undertaken this year as follows:

1. To procure descriptions of several systems of keeping fixed capital records in use by some of the member-companies, together with all forms used in connection therewith.

2. To make a complete list of the so-called indirect or undistributed items of cost, prepare a discussion of these items and their relation to Fixed Capital and recommend a method of distributing these elements of cost to individual projects in order that they may become a part of the Fixed Capital.

3. To design a model system of Fixed Capital Records, with forms, together with a complete description of their use and instructions for maintaining such a system.

In order to facilitate the work and get the most efficient results the Committee was divided into sections or groups. The Western Section under the leadership of Mr. F. L. Conrad, was assigned the work of designing a model system as outlined under "3" above. Messrs. A. C. Klein and C. A. Schlegel were assigned the work of writing a discussion on the in-

direct or undistributed items of cost entering into Fixed Capital as outlined under "2" above. The other members of the Eastern Section of the Committee undertook the work of procuring descriptions of systems pertaining to Fixed Capital as outlined under "1" above.

Remarks on the Reports by the Sub-Committees

The work outlined has been completed and is made a part of this report in the following order:

Description of a System of Fixed Capital Records now in use by the St. Paul Gas Light Company of St. Paul, Minn., by Mr. C. L. Nelson.

Discussion of Indirect or Undistributed Items of Cost, by Messrs. A. C. Klein and C. A. Schlegel.

Proposed System of Fixed Capital Records with Forms, by Mr. F. L. Conrad.

Supplementary Fixed Capital Record Forms, by Mr. E. L. Heyser.

Several systems actually in use, of keeping Fixed Capital Records, were studied by the Committee, but there is submitted in this report only one, which the Committee felt was in such detail as to be helpful to the member-companies and to show the strides that are being made by companies in this direction. The other systems submitted were, however, helpful to the Committee in arriving at its conclusions. In this connection the Committee desires to thank the companies who have submitted data and forms for their cooperation.

It will be noted in connection with the St. Paul system that field engineers are held responsible for the accuracy of the information submitted to the Fixed Capital Records Division. The Committee feels that in any system installed or to be installed at least one engineer be made part of the personnel necessary to maintain the record in its entirety.

In the report on Indirect or Undistributed Items of Cost by Messrs. A. C. Klein and C. A. Schlegel, the Uniform System of Accounts for Gas Corporations adopted by the National Association of Railway and Utilities Commissioners has been followed.

The Committee has confined its discussion to the so-called overhead, general, indirect or undistributed items of cost of the tangible property. Heretofore, these items have not generally been given proper consideration by many of the public utilities, in the matter of charging the proper proportion to capital, and it is the earnest hope of the Committee that this report may be found helpful to the companies in their consideration of this subject.

The proposed methods for keeping Fixed Capital Records, included in this report, do not embody the perfect system that the Committee would like to see incorporated herein. Perfecting a system in the time allotted was found to be a physical impossibility. In addition to this fact it was the unanimous opinion that no system could be designed to take care of all the requirements of every company. In other words, the ultimate system will, no doubt, have to be modified to meet the particular requirements of each company. The system submitted does, however, represent a general scheme and the forms included, together with the de-

scription of their use, should be helpful to companies who contemplate the installation of a system of fixed capital records.

Recommendation for the Future

We believe that a Committee should be appointed to carry on the Fixed Capital Records work next year. This Committee by keeping in touch with the systems being installed from time to time would be able to compile information covering the use of such records that would be of great value to the public utilities throughout the country.

FIXED CAPITAL RECORDS

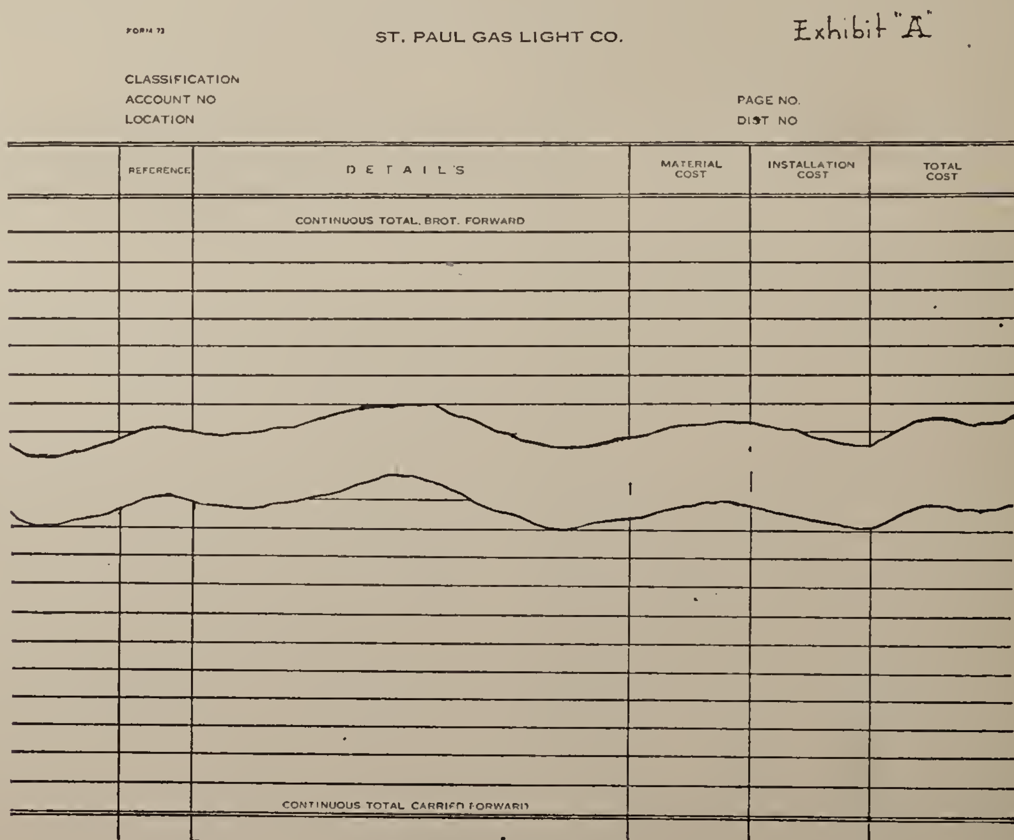
St. Paul Gas Light Co., St. Paul, Minn.

C. L. Nelson, St. Paul, Minn.

The following description and forms explain in a general way the method of keeping Fixed Capital Records and a Perpetual Inventory of the properties of the Saint Paul Gas Light Company. The adoption of this system has necessitated the addition of three new forms to the list of forms already used by the Accounting department. These forms are shown as Exhibits A and B, following; a third form not shown being practically a duplicate of Exhibit B except that it is printed on yellow paper.

Exhibit "A" is the form for the manuscript from which the typewritten record is made. Exhibit "B" is the form for the typewritten record, which is taken from the manuscript copy, and is bound in a special ledger binder known as the "Plant Ledger."

The third form which is practically a duplicate of Exhibit "B", is filed in district order in a steel file. The entire city has been divided into forty-four districts. Each district is one mile wide by



ST. PAUL GAS LIGHT CO.

Exhibit "A"

CLASSIFICATION
ACCOUNT NO
LOCATION

PAGE NO.
DIST NO

	REFERENCE	DETAILS	MATERIAL COST	INSTALLATION COST	TOTAL COST
		CONTINUOUS TOTAL, BROT. FORWARD			
		CONTINUOUS TOTAL CARRIED FORWARD			

Actual Size 8½" x 11"

FORM 72 ST. PAUL GAS LIGHT CO. Exhibit "B"

CLASSIFICATION Boiler Plant Equipment
ACCOUNT NO. 314 PAGE NO.
LOCATION Upper Levee DIST. NO. 26

REFERENCE	DETAILS	MATERIAL COST	INSTALLATION COST	TOTAL COST
	CONTINUOUS TOTAL BROT. FORWARD			
	Installing a Connelly Class C-C-13 260 H.P. 160# working pressure boiler, Foster Superheater, 50° Superheat and Harrington Stoker, 50 Sq.Ft. grate Surface at Upper Levee Station. Cost to Jan. 1, 1922 = $14,840.53			
	Foundation			
S0449	Foundation and install forced draft equipment for boiler	104.14	348.73	
V47315	Hauling 2 loads of crushed rock		5.00	
V47324	Hauling concrete mixer to Levee		2.78	
T2131	Hauling Concrete mixer to Edison Station		2.00	
TV28	Use of concrete mixer #5 - 8 hours @ $1.00	8.00		
	Fire Brick			
V47490	Brick Arch - Leptak Fire Brick Co.	399.00		
V47490	Freight - Leptak Fire Brick Co.	15.58		
V47419	Fire brick A.P. Green Fire " "	5.96		
T2169	Hauling Brick		2.00	
T2197	Hauling 54 #132 Arch Blocks		4.00	
T2188	Hauling 1 Beams		1.50	
	Brick Setting			
V47296	Bricking boiler, A.W.M.Anderson	831.00		
V47296	Walls for air duct		16.50	
V47529 V47835	25 bbls. Lime	48.90		
V47539 V47828	20 yards - Sand	28.00		
V47677	600# Insulatum	55.86		
V47554	Smoke stack and erecting - Contract	1188.00		
V47263	Foster Superheater	262.50		
V48050	Bailey boiler meter	609.00		
S01021	Installing Bailey Meter	41.61	114.09	
V49658	Freight and drayage		4.93	
	CONTINUOUS TOTAL CARRIED FORWARD	3597.55	501.53	

Actual Size 8½" x 11"

one and a half miles long. That part of the county lying outside of the city limits has also been divided into districts and given a separate series of numbers such as "County District No. 1," "County District No. 2," etc. This has been done in order to make a separation between property within the city and property outside the city. The city and county districts are closely linked up with the 100-foot map system used by the company. Each map takes in an area one-third of a mile wide by one-half of a mile long. Each district includes nine map districts. The object of the division into districts is to simplify the checking of the quantities in the field and to reduce the size of the units handled.

Exhibits "C", "D", "E", and "F" are examples of work orders, shop orders, and sales orders from which entries are made in the Plant Ledger. Entries are also made from vouchers. The reference column on the ledger sheet (Exhibit "A") bears the numbers of work orders, shop orders, sales orders, or vouchers, with the prefixes W.O., S.O., or V., from

which entries are made. Thus, at all times, the Plant Ledger is an index giving a direct reference to the sources of information, where the details may be found.

Field engineers are responsible for the accuracy of the information submitted to the Fixed Capital Records division. They keep constantly in touch with the engineering work that is being carried on at the various plants in order that they may be in a position to vouch for the reports of material and labor used on any job.

The records are made to conform with the Uniform System of Accounts as prepared by the National Association of Railway and Utilities Commissioners. Forms for summarizing have not been made up as yet, but will undoubtedly be very similar to the forms for details.

CREDIT ACCOUNT NO. 509		
LABOR	40	68
LIABILITY INSURANCE		81
MATERIAL	22	32
MACHINE OPERATING ACCOUNT		
PURCHASING AND STOREROOM	2	23
ENGINEERING AND SUPERINTENDANT	10	54
HAULING	4	20
TOTAL	80	78

CHARGE ACCOUNT NO. 323 E
"C-1

ENTERED 19__

Bookkeeper

ST. PAUL GAS LIGHT CO.
Acct. Dept. Copy
GAS DISTRIBUTION WORK ORDER Form 311 NO. 6071
ADDRESS 352 S. Robert St. DATE 1-6-23
NAME Heckstein & Rehnau MAP NO 30 N-33
NATURE OF ORDER Run gas service CONTRACT NO. 2355
2" service PERMIT NO. 1766
On main
Issued by Coml. Dept.

NAME	DATE 18	DATE 9	Total Hours	RATE	AMOUNT	
L. B.	8	4	12	150	8	88
La.	32	16	48	450	27	00
Truck	3	3	6	70		
Driver	3	3	6	163	4	80
				4.20		
TOTAL LABOR					40	68

MATERIAL

QUANTITY	ARTICLE	Catalog No.	PRICE	COST	
1	2" Ser. Tee	4141			80
1	2x1x2 Ser. Tee	4104			47
2	2" Com. Ells	4008			66
2	2" St. "	4046		1	05
1	1" Plug	4347			02
2	2" "	4350			12
42'	ft 2" Pipe	3909	1473	6	19
1	2" I B Gate Valve	4538		3	76
1	Stop box & cover	3567		5	52
1	" " Extension	3553		1	52
1	" " Low Sec.	3552		1	95
2	Gals. Kerosene	3460			26

COMPLETED 1/19/23 CHECKED BY J Powers TOTAL 22 32
Clerk

Front **Back**

Exhibit C—Actual size 6" x 4"

ORIGINAL
Form 54

St. Paul Gas Light Co.
SHOP ORDER

Date 2-9-22   No. 34001
Charge 11092   Credit 1901
Service Dept.   Shop

Nature of Order To install electric wiring and lights for Connelly Boiler at Levee as directed by Mr. Ruth

Request of E. H. Cotton

LABOR

NAME					Total Hours	Rate	Total
W. Johnson	13				13	.65656	8.53
Joe Kryomski	13				13	.75	9.75
J. Gordon	13				13	.71875	9.34
G. Cummings	13				13	.625	8.13
Truck #4	13				13	.375	4.88
					(February)		40.63

MATERIAL

Material listed on reverse side of this ticket (March) 18.79

Indirect Expense

Completed 2/11 by W. Johnson   Total Cost 59.42

120 Ft. 1/2" Gal. conduit		1057	6.84
6 " Outlet boxes		.25	1.50
6- " " " Covers			.75
2- " L.B. condulet		.37	.74
2- " " " Blk.covers		.07	.14
12- " Locknuts		.016	.19
12 " Bushings		.035	.42
5 Sign receptacles			1.90
12-1/4 x 3" Toggle bolts		.04	.48
12-1/4 x 1 1/2" Stove bolts		.005	.06
20 Ft. Perforated Iron		.029	.58
235 Ft. #14 R.C. wire			3.17
6-A1 Cable clamps			.18
12-2" x 1/4" Pierce bolts		.075	.90
12-10" Hacksaw blades		.05	.60
1 Sign receptacle			.34
			18.79

LABOR

Johnson	13
Joe	13
Gordon	13
Cummings	13
Truck #4	13

Front   Back

Exhibit D—Actual size 6" x 4"

Form No. 1008

Copy 6
To Engr. Dept.

ST. PAUL GAS LIGHT CO.   4" 39   71-33
Installation of Gas Service Pipe Connections
AUTHORIZATION FOR INSTALLATION   No. **2355**

Date of Authorization 1-5 1923   Date of Application 1-3-23 192

INSTALLATION ADDRESS 332 So. Robert St.

NAME Heckstein & Behnau   OWNER / TENANT / PLUMBER

PRESENT ADDRESS Same

KIND OF BUILDING Factory ~~Old~~ New   ON MAIN ~~St.~~ Ave.

Nature of Order Chg

To be filled in when work is completed

Pipe laid from main in street to meter in basement 41 feet

Pipe laid from main in street to lot line 22 feet

Pipe laid from lot line to meter in basement 19 feet

Amount of charge 19 ft.; Size of pipe 2 inch; Charge per ft. 65 c Amount $ 12.35

Add Winter charge 41 ft.   Charge per ft. 45 c Amount $ 18.45

Add extra charge ft. % rock formation   Charge per ft. c Amount $

Total   Amount $ 30.80

Date work completed 1/9 1923   Gas Dist'b Work Order No. 6071

Date Billed 192   Foreman L. Big

Return this order to the Company's Commercial Department when completed

Date forwarded to Accounting Department 1-19 1923

Exhibit E—Actual size 6" x 4"

ST. PAUL GAS LIGHT CO. Form 66 NO. **1021**

Acct. Dept. Copy **HILL STREET SHOP WORK ORDER** DATE 2-23-22

NATURE OF ORDER To install Bailey Meter on Connelly boiler at Levee CHARGE ACCT. NO. 11153

Request of E. H. Cotton

MATERIAL

Amount	Cat. No.	Article	Price	Cost
4	4001	1/4 Ell	.0653	.26
2	4177	1/4 x 1/2 Red Coupling	.044	.09
2	4261	1/4" Union	.117	.24
1	4039	1/4" Str. Ell	.111	.11
130#		1/4" Boiler Steel	.06	7.80
32#	4844	2 x 2 x 1/4 Angle iron	.032	1.02
12	2663	5/16 x 1 1/2 Stove Bolts	F.H.	.10
14#	4872	3/8 x 2 iron	.03	.56
3	4344	3/8 plugs	.0122	.04
1	4479	3/8 air cocks	.20	.20
4	4245	1/2" cross	.127	.51
6	4068	1/2" corn. Tee	.07	.42
			TOTAL	41.67

Credit Account No. 2131

Labor	Material	Machine Operating Acct.	Indirect Expense	Total
85.57	41.67		28.52	155.70

Entered ______ 192__ Bookkeeper ______

Front

LABOR

NAME	2/23	2/24	2/25	2/27	2/28	3/1	3/2	Total Hours	Rate	Amount
C. Gilbert	2½							3½	.8125	2.84
C. Burk	2½							2½	.625	1.56
W. Howell	4	8½	4	8½	8½	8½	6½	62½	.5625	35.16
H. Woods	4			½				4½	.5625	2.53
M. Harder		8½	4	1½	6½		6½	33	.75	24.75
B. McCormick				8½				8½	.625	5.31
F. Crippen				8½				8½	.75	6.38
O. Kuklman					½			½	.78125	.39
H. Maske					3			3	84	2.52
	3/3	3/4	3/7	3/13						
W. Howell	6	3	1	4						
J. Beahan	1							1	75	75
F. Ruhavy	1							1	625	63
M. Harder	6									
J. Schmidt				4				4	.6875	2.75
C. Gilbert				1						
									TOTAL	85.57

Completed 3/14 192 2

Checked by H. E. Haugen Shop Clerk

Back

Exhibit F—Actual size 6" x 4"

DISCUSSION OF INDIRECT OR UNDISTRIBUTED ITEMS OF COST

A. C. Klein, Boston, Mass., and C. A. Schlegel, Philadelphia, Pa.

During the period of initial construction of an industrial enterprise, before operations have been commenced, the inclusion in the capital accounts of the total cost of the property is a simple matter. After that period, however, when plant operations and extensions are going on simultaneously, the classification of costs between operating expenses and construction, particularly the indirect items which may be applicable in part to both, becomes more difficult.

In a public utility, where the price of the product is based upon operating expenses plus a return on the property devoted to the service of its customers, it is most important that expenditures incurred for operation and for construction be properly segregated. While large companies may have separate construction departments, in the smaller companies the same employees may devote part of their time to operation and part of their time to construction, making it difficult to separate properly construction cost from operating cost.

We believe that it has been the tendency for Public Utilities, in many cases, to charge too small a proportion of such expenditures to capital and too large a proportion to operation, due in part to the difficulties of making accurate distribution and in part to the fact that such employees are usually engaged primarily on operating activities. This has the effect of burdening present consumers with expense incurred for the benefit of future consumers.

The principal elements of fixed capital which are affected by this practice, and which are consequently too low, are the elements which are variously termed "general," "indirect" or "undistributed" costs.

These items are frequently incorrectly called "intangibles," but on this point the Uniform System of Accounts for Gas Corporations adopted by the National Association of Railway and Utilities Commissioners is quite clear.

As this classification is receiving consideration generally for adoption by State Public Utility Commissions and by gas corporations throughout the country, and because of the very common confusion which exists in respect to elements of tangible fixed capital, we quote its definition of tangible and intangible capital. The Uniform System of Accounts defines fixed capital (page 27) as,

"the property, both tangible and intangible, which is devoted to the accomplishment of the principal purpose of its business and which has an anticipation of life in service of more than one year."

Tangible property is defined, on the same page, to include "Such overhead expenditures for engineering, taxes during construction, etc., as can be allocated to definite items of property."

Intangible property is defined, on the same page as "Organization expenditures and rights, privileges and other property not physical, such as franchises or patent rights."

These definitions clearly show that the Commissioners intended all overhead costs to be allocated where possible to elements of property, or to the units of the inventory.

Additions to property made through contracts with separate construction companies will usually contain more of the elements of cost than additions made by the operating company itself with its own construction department, or with its own operating force. The separate construction company furnishes the means to create the addition at a certain definite cost, while the local construction department or operating force will use existing facilities and personnel which are normally and often simultaneously used for operation, and may charge little or none of this cost to the capital addition. The result is that the addition to capital is often less than the true cost.

The discussion of the elements of the cost of tangible property which follows is presented to enable companies to properly capitalize property additions made from time to time, without the assistance of outside construction companies.

Two elements of cost, material and erection labor are always included in the cost of any item of property, but the indirect elements are not so easily distinguishable, and are frequently omitted. We believe that the following definitions of the elements of cost will assist companies doing their own construction work to properly charge the direct as well as indirect elements of cost to Fixed Capital.

ELEMENTS OF COST OF FIXED CAPITAL TANGIBLE PROPERTY

Material

Material is that element of cost which covers purchase price, storeroom expense and all material and labor expense incurred in rendering the item of property available to the construction force.

Freight and Cartage

Freight and cartage is that element of cost which covers the transportation expense incurred in transporting the item of property from the point of manufacture to the site of installation.

Erection Labor

Erection labor is that element of cost which covers the direct labor expense, common, skilled and foreman, incurred at the site of installation, in the assembly and installation of the item of property.

Drawings

Drawings is that element of cost, which covers the expense of design and preparation of drawings necessary for the manufacture and installation of the item of property.

Tools and Equipment

Tools and equipment is that element of cost which purchase price less salvage or resale value, rental, transportation, operation, installation and dismantling expense incurred in the use of tools and construction equipment, necessary for the installation of the item of property.

Temporary Structures

Temporary structures is that element of cost which covers structures for construction purposes only, such as buildings, roads, water lines, camp, compressor plant, power plant, etc.

Inspection

Inspection is that element of cost which covers the expense involved in securing the sub-contractors' adherence to specifications in the manufacture and fabrication of the item of property involved.

Expediting and Tracing Material

Expediting and tracing material is that element of cost which covers the expense involved in securing prompt shipment and delivery to the site of installation.

Insurance

Insurance is that element of cost, which covers the cost of fire, damage and liability insurance, accidents, injuries and damages during the construction period.

Field Supervision

Field supervision is that element of cost which covers the expense of Field Engineers, Surveyors and General Foremen.

Field Office Expense

Field office expense is that element of cost which covers the expense of field accountants, paymasters, clerks, stenographers and the operating expenses of the field construction office.

Preliminary Operation

Preliminary operation is that element of cost which covers the expense incurred in the operation of the items of property to insure correct and economical operation prior to its entrance into commercial service.

Interest During Construction

Interest during construction is that element of cost which covers the cost of capital during the construction period.

Taxes During Construction

Taxes during construction is that element of cost which covers the taxes levied upon permanent and temporary property during the construction period.

Law Expenditures During Construction

Law expenditures during construction is that element of cost which covers all legal and court expense incurred in connection with the construction work.

Miscellaneous Construction Expense

Miscellaneous construction expense is that element of cost which covers generally all expenditures which cannot be allocated directly to any of the preceding elements and includes services of general engineers, accountants and clerks, general expense such as rent, light, heat, purchasing, and other general services rendered the item of property.

* * * *

It is difficult, if not impossible, to formulate a "hard and fast" method for the distribution of the proper proportion of combined expenditures to construction

and to operation accounts, therefore, it is recommended that each company make a study of its own conditions for this purpose. One method which suggests itself is to divide such expenses in proportion to the total construction expenditures as compared with the total operating expenses, but we believe that the better method is to require employees whose duties are partly operating and partly construction to keep time cards.

The accounting practice of many member companies is somewhat as follows:

An accurate classification is made of material issued from the storeroom for construction purposes and in most cases general storeroom charges, such as labor, rent, light, freight, cartage and hauling, etc., are included in the unit prices at which materials are issued. All direct labor is accurately classified on time cards, which classification usually includes the gas works foreman and the main and service foreman. Other employees, such as executives and all general employees in the accounting and purchasing departments, do not as a rule keep accurate record of their time, and for the most part their salaries are entirely charged to some operating account. Such general expenses as office rental, supplies, insurance, taxes and interest are all charged to current operation.

* * * *

In the following paragraphs we have listed the operating accounts of the National Association of Railway and Utilities Commissioners' uniform Accounting System for gas corporations, and have noted cautions under those accounts which are liable to be charged with items of expense which should be directly charged to the proper Fixed Capital account.

Account 701.0—Works Superintendence

This is principally an operating account. Care should be taken that any time of superintendents, assistants, day foremen and station clerks spent on construction is charged directly to the proper Fixed Capital account and not to this account.

Account 701.2—Boiler Labor

No part of this account is chargeable to construction, unless steam is consumed for construction purposes, in which case it will be simpler to charge construction with the estimated cost of steam consumed, through account 712.

Account 701.3—Retort Labor
Account 701.4—Generator Labor
Account 701.5—Purification Labor

These are all wholly operating expenses.

Account 701.6—Miscellaneous Works Labor

This is principally an operating account, but care should be taken that any time of employees on construction, whose time is generally charged to this account, is charged directly to the proper Capital Account and not to this account.

Account 702.1—Boiler Fuel

See 701.2.

Account 702.2—Water

Same as 701.2. In the case of new gas holders, however, the cost of water used for filling them should be charged to construction. Similarly, all water used for construction purposes.

Account 703—Fuel Under Retorts
Account 704—Coal Carbonized
Account 705—Generator Fuel

Account 706.—Water Gas Oil
Account 707.1—Coal Gas Enricher
Account 707.2—Purification Supplies

These are all wholly operating expenses.

Account 707.3—Miscellaneous Works Expense

This is principally an operating account, but care should be taken that the cost of any supplies or any expense in connection with construction work is charged directly to the proper Fixed Capital account and not to this account.

Account 707.4—Gas Storage

Entirely operating.

Account 708—Maintenance of Works and Station Structures

While some part of this expense might theoretically be chargeable to construction, it will probably be a very small amount and it would be simpler to consider all expenses for maintenance of structure as an operating expense.

Account 709.—Maintenance of Works Equipment and Apparatus
Account 709.1—Maintenance of Power Equipment

See 708.

Account 709.12—Maintenance of Furnaces and Boilers
Account 709.13—Maintenance of Boiler Apparatus

See 701.2.

Account 709.14—Maintenance of Steam Accessories
Account 709.15—Maintenance of Steam Engines
Account 709.16—Maintenance of Internal Combustion Engines
Account 709.17—Maintenance of Miscellaneous Power Equipment
Account 709.21—Maintenance of Benches and Retorts
Account 709.22—Maintenance of Water Gas Sets
Account 709.23—Maintenance of Purification Apparatus
Account 709.24—Maintenance of Holders
Account 709.25—Maintenance of Accessory Works Equipment
Account 709.26—Maintenance of Laboratory Equipment

All of the above are entirely operating expenses.

Account 709.27—Maintenance of Implements and Accessories

This is principally an operating account, but care should be taken that any expenditures made on account of construction work is charged directly to the proper Fixed Capital account and not to this account.

Account 710.—Gas from Other Sources
Account 711.—Power from Other Sources

Charge entirely to operation.

Account 712.—Steam Generated Apportionment Account

Cost of any steam used for construction work should be credited to operation through this account, at an estimated cost including fuel, labor and boiler plant maintenance.

Account 713.—Residuals Produced
Account 714.—Residuals Expense
Account 715.—Duplicate Production Charges
Account 716.—Production Charges Transferred
Account 721.1—Transmission Pumping

Wholly operating accounts.

Account 721.21—Distribution Superintendence

Account 721.22—Distribution Supplies and Expenses

This is principally an operating account but care should be taken that the cost of any supplies or any expense in connection with construction work is charged directly to the proper Fixed Capital account and not to this account.

Account 721.31—Maintaining Installations

Account 721.32—Work on Consumer's Premises

Account 721.4—Removing and Resetting Meters

Account 722.1—Maintenance of Mains

Account 722.2—Maintenance of Service

Wholly operating accounts.

Account 722.31—Maintenance of Shop Buildings

Account 722.32—Maintenance of Distribution Implements and Accessories

This is principally an operating account but care should be taken that any expenditures made on account of construction work is charged directly to the proper Fixed Capital account and not to this account.

Account 722.33—Maintenance of Gas Appliances

Account 723.—Maintenance of Consumers' Meters

Account 724.—Duplicate Distribution Charges

Account 731.—Operation of Street Lamps

Account 732.—Maintenance of Street Lamps

Account 761.—Commercial Administration

Account 762.—Agents' Commission

Wholly operating accounts.

Account 770.—New Business Expenses

A small amount of the expenses of the New Business Department is probably chargeable to construction, but this is so small that it would be simpler to charge it all to operation.

Account 781.11—Administrative Salaries

Account 781.12—Other General Office Salaries

Account 781.21—General Office Supplies and Expenses

Account 781.22—General Stationery and Printing

Account 781.23—Maintenance of General Structures

This is principally an operating account but care should be taken that any expenditures made on account of construction work is charged directly to the proper Fixed Capital account and not to this account.

Account 781.24—Law Expenses

Account 781.25—Insurance

Account 781.26—Stores Expense

Account 781.27—Transportation Expense

A strict interpretation of the Uniform Accounting Systems instructions should be followed so that all expenditures in connection with construction are charged to a capital account.

Account 781.28—Other Miscellaneous General Expenses

Account 781.29—Undistributed Adjustments

Account 782.—Retirement Expense

Wholly operating accounts.

Account 783.—Injuries and Damages

Charges to these accounts can be readily classified and charged direct either to operation or to construction.

Account 784.—Regulatory Commission Expenses

Wholly operating.

Account 785.—Relief and Welfare Work

Care should be taken that any expenditures made on account of construction work are charged directly to the proper capital account.

Account 786.—Franchise Requirements

Account 787.—Amortization of Franchise Requirements

Account 788.—Gas Expenses Transferred

Account 789.—Joint Operating Expenses

Account 790.—Duplicate Miscellaneous Charges

All operating expenses.

* * * *

In conclusion we wish to recommend that a proper proportion of the various undistributed or indirect items of cost be charged directly to Capital and believe this can best be accomplished by the use of the time card system.

PROPOSED SYSTEM OF FIXED CAPITAL RECORDS

F. L. Conrad, Chicago, Ill.

The general instructions in the Uniform Classification of Accounts for Gas Utilities as prepared and published by the National Association of Railway and Utilities Commissioners state that "every debit or credit to the fixed capital or other investment account must be made in such wise as to be readily identified with the particular item of property to which it relates. For each item of fixed capital or other investment the records shall show the date of the entry, the date of acquisition or installation, the date when placed in service, the actual money cost, and the description thereof with such particularity as to make possible the location and identification thereof (including, in case the item is movable, the name of the manufacturer and the identifying mark or number, if any, imprinted thereon, and such other particulars as may be necessary for identification). Where two or more items are acquired under a single undivided contract, the entry in respect of each shall refer to the others and shall state the entire consideration, and shall also state the portion thereof fairly applicable to the particular item covered by the entry. When any item of capital is withdrawn from service, the date of withdrawal shall be included in the withdrawal entry relating to such item."

The instructions further state "that to the end that the capital accounts shall at all times disclose the cost of all property in service, the cost of retired capital, whether replaced or not, must be deducted from (i.e., credited to) the account, or accounts, in this classification to which such cost is chargeable. Every gas corporation is, therefore, required to take such measures and establish such procedure as will insure strict compliance with these requirements. When anything is worn out, lost, sold, destroyed, abandoned, surrendered upon lapse of title, becomes permanently unserviceable, or is withdrawn or retired from service for any other reason, the amount at which such thing stood charged in the capital account shall be credited to the appropriate capital account, and the entry of such credit shall cite by name and page of book or other record the original entry of cost of the thing retired. If there is no such original entry, that fact shall be stated in connection with the credit entry. If the amount originally charged (i.e., the ledger value) is not separately recorded, it shall be taken to be the proportionate share of said property in the value of the entire group in which the property is included. The entry shall state the fact of such estimation. Credits for original cost of property retired should include such part of the overhead costs as is equitably assignable to the item retired."

In order to carry out the instructions as outlined above the Committee feels that it is necessary to install a system which will in certain respects automatic-

ally take care of plant additions and withdrawals.

For the large companies a special department should be installed for keeping records of the inventory. For the smaller companies some one within the organization should be held responsible for the work in this connection. The department should have at least one competent engineer on its staff who has had inventory experience or at least is capable of

WORK ORDER NO.

REQUEST FOR WORK ORDER

DATE ~~June 1, 1923.~~

ACCOUNT NO. ~~318~~ Water Gas Sets

DESCRIPTION OF WORK

Furnish and install one 12'-6" U.G.I. Water Gas Machine.

REASON FOR WORK -

DATE WORK IS TO BE STARTED July 1, 1923 DATE WORK IS TO BE COMPLETED August 23, 1923

QUANTITY	DESCRIPTION			AMOUNT	
1 -	12'-6" U.G.I. Water Gas Machine, Contract			$19,000	00
	Material from stores			2,100	00
	Labor			3,600	00
	TOTAL			$24,700	00

BUDGET ITEM COVERING PROPOSED WORK

SIGNED ~~John Doe~~

Engineers' DEPT.

Exhibit A—Actual size 11" x 8½"

reading plans, interpreting specifications, etc., as the information necessary in connection with a system of continuous inventory requires that investigations regarding physical property be made in the field and from engineering records of the company. As a great portion of the work, however, particularly that pertaining to costs, would automatically come from the accounting department in the design of a system of continuous inventory and withdrawals, we do not deem it necessary to interfere with the present methods of the accounting departments, particularly that phase of their work which pertains to the summary of payrolls, segregation of construction costs, etc.

Before a system is adopted or installed by a company it is necessary to first adopt a classification of accounts. This classification should conform to the State Utility Commission Classification under which the utility operates, or if no state classification is available, the classification which is promulgated by the National Association of Railway and Utilities Commissioners, and which has been adopted as the official classification of the American Gas Association, should be used.

In designing the system we have taken for granted that every public utility company has a work order system together with such underlying forms which show the amount of labor and material charged to the various construction jobs, and we have eliminated from our discussion such details and will only include herein the major forms which are necessary to put in what might be termed a complete detailed inventory system. It should be borne in mind at this time that by the use of the word "inventory" we mean the detailed quantities that go to make up the physical units together with the detailed costs of such units.

From the issuance of the construction work order to the completion of the property record, the work of recording transactions in their final form should be assigned to the inventory department.

When the department responsible for certain construction work is ready to begin a job, such department should make out a request for a work order which is shown as Exhibit "A." This request for a work order should give a definite description of the work to be done, the location, the date of the proposed starting and completion and a detailed estimate of the cost of the job. This estimate of cost should show separately the equipment and material to be purchased, the material taken from stock and the equipment to be transferred from other locations, together with the necessary labor for erection, etc. This request for a work order is forwarded to the inventory department where it is classified as to the proper fixed capital account and given a work order number.

Where possible the request for a work order should be classified in accordance with a fixed classification of accounts. Where work is to be done under two or more accounts, separate requests for work order number should be sent through. This is done in order to properly classify the fixed capital accounts by account numbers.

Upon receipt of the request for work order the inventory department should make up an official work order sheet, Exhibit "B," from the information as shown on the request for work order and the department should obtain on this sheet the proper official signatures authorizing the work to be done. When the work order has finally been approved notification of this is returned to the department issuing the original request for

ACCOUNT NO. ~~318~~

DESCRIPTION OF WORK

WORK ORDER

WORK ORDER NO. 1110

DATE July 15, 1923

Install 12'-6" U.G.I. Water Gas Set at ____ Station

Complete with foundation piping, etc.

ISSUED TO John Doe - Engineering Dept.

QUANTITY	DESCRIPTION	AMOUNT	
1 -	U.G.I. 12'-6" Water Gas Machine, Contract	$19,000	00
	Material from Stores	2,100	00
	Labor	3,600	00
		$24,700	00

BUDGET ITEM NO 000 AMOUNT $24,700.00

DESCRIPTION

PREVIOUSLY ISSUED ________ BALANCE AVAILABLE ________

CASH REQUIRED FOR THIS WORK ORDER ________

REMARKS: ________

VICE PRESIDENT

GEN'L SUP'T

GEN'L ACCOUNTANT

PROPERTY ENGINEER

CONTROL DEPT.

GEN'L STOREKEEPER

SALES MANAGER

CONTROLLER

Exhibit B—Actual size 11" x 8½"

work order and is authority for said department to proceed with the construction work.

In order to properly keep track of the various work orders outstanding, records should be kept by the inventory department which will show the work order number, district or station, account number, date issued, estimate of cost and the date closed. Sample of this form is shown as Exhibit "C." In keeping a rec-

ord such as this the department will at all times be posted as to the status of the work and the moneys necessary to perform such work, and will be guided at all times as to changes in plant account.

Instructions should be issued to the engineering and construction departments that all copies of contracts, drawings, specifications, etc., should be sent to the inventory department or the inventory department should have access to such information and records. The inventory department should also have copies of the field engineers' construction records. Copies of such records are necessary in order that the inventory compiled by the department will give complete specifications, dimensions, weights, details of foundations, connections, temporary structures, etc.

In order to properly classify the various classes of materials and labor which go to make a complete operating unit we believe that each construction job should be sub-divided into approximately the following sub-accounts or such of these as are applicable:

(a) Preparing site.
(b) Excavating and backfilling.
(c) Foundations including piling and reinforcing.
(d) Buildings complete excluding foundations.
(e) Equipment installed complete exclusive of foundations.
(f) Steam piping and connections.
(g) Water piping and connections.
(h) Gas piping and connections.
(j) Electric conduit and wiring.
(k) Oil lines and connections, etc.
(o) Miscellaneous:
Drawings, Tools and Equipment, Temporary Structures, Inspection, Expediting and Tracing Material,

SHEET NO. 1

WORK ORDER INDEX

	WORK ORDER NUMBER		DISTRICT OR STATION	ACCOUNT NUMBER	DATE ISSUED	ESTIMATED COST		DATE CLOSED
	1110		Station	318	July 15, 1923	$24,700	00	August 30, 1923

Exhibit C—Actual size 11" x 8½"

DETAILED MATERIAL AND LABOR RECORD

WORK ORDER 1110
JOB NUMBER
FILE NUMBER 214
SHEET NUMBER 1
MONTH OF July 1923
DEPARTMENT HEAD

ACCOUNT NAME Water Gas Sets ACCOUNT NO. 318 SUB-ACCOUNT e

DATE	REQUISITION NO. INVOICE NO. LABOR ROLL NO. J. E. NO.	QUANTITY	DESCRIPTION	STOCK CLASS	PRICE	STOCK REQUISITION	MATERIAL OTHER THAN STOCK REQUISITION	LABOR	MISCELLANEOUS
			Describe in detail various items of Labor and Material giving contract number, specifications, etc. - Using a new sheet for each Sub-Account.						
			TOTAL — FOR MONTH						
			TOTAL — TO DATE						

Exhibit D—Actual size 16" x 11"

Insurance, Field Supervision, Field Office Expense, Preliminary Operation, Interest During Construction, Taxes During Construction, Law Expenditures During Construction and Miscellaneous.

Other sub-accounts can be added, or any of the above accounts sub-divided to meet the operating company's requirements. The engineering or construction departments should be instructed to charge all items of equipment and labor to the various sub-accounts to which they belong. For instance, all labor necessary to erect a certain item of equipment should be charged direct to sub-account "(e)."

All undistributed items of cost such as temporary buildings and temporary water and steam lines, drawings, insurance, etc., which are of such nature that they would not be identified if a field inventory of the physical property were taken at the completion of a construction job should be charged direct to sub-account "(o)" or to the proper sub-division of this account.

With these various rules as outlined above put into effect, it then becomes an easy matter to segregate the various items of plant equipment and charge them to the item of plant to which they belong.

The various elements of cost which go to make up a completed construction job should be transferred to Exhibit "D," using a new sheet for each sub-account under a given work order.

Exhibit "D" shows the dates of materials purchased or taken from stores, and the quantities of materials taken from stock or purchased under contract, etc. This exhibit refers to requisition and invoice numbers, job number, journal entry numbers, etc., and ties back to the accounting records and details. Under "Description" complete detail should be given of each item purchased. For instance, the detail necessary for a description of the item of equipment would be all the facts as outlined in the specifications of the equipment purchased. Details for installation of pipe should give lengths of pipe, size of fittings, etc. When the job has been completed the details as shown on Exhibit "D" should be summarized and transferred to the final inventory form shown as Exhibit "E." This final inventory form should be written up in such a manner as to give the salient feature in connection with each installation. The equipment should be detailed, giving the manufacturers' numbers, etc. Foundations should be detailed as to quantities of materials, labor, etc., and reference should be made to engineering blue prints, specifications, etc. The reference column as shown on this form is for the sole purpose of referring back to the details as shown on Exhibit "D." In order to properly fill out Exhibit "E" it will be necessary that a complete field inspection be made in order to get the necessary and complete details as called for by the instructions in the Uniform Classification of Accounts by the National Association of Railway and Utilities Commissioners.

When all costs in connection with the job have been completed and the final inventory summary filled out, the inventory department should then write up a complete story of the job, giving all engineering details in connection therewith. This record will be very helpful if at any future time it should be necessary to appraise the property on any basis whatsoever for presentation in rate cases, in-

FINAL INVENTORY SUMMARY

ACCOUNT NAME 318 - Water Gas Sets WORK ORDER NO. 1110

LOCATION Blank Station REFERENCE FILE NO. 3

REFERENCE	DETAIL	QUANTITY	UNIT COST	EXTENSION	TOTAL
1110-a	Preparatory Work -				
	Removal of obstruction and preparing ground for new mach-ine - Labor	1 Job		$375 00	
	Material	"		75 00	
	Cartage			10 00	
					$460 00
1110-b	Concrete Foundation -				
	Excavation - Blue Print No.11248	120 cy	P.R.	140 00	
	Pumping - Rent of Pumps see Contract #1089	11 Dys	10.00	110 00	
	Coal, oil, etc.	1 Job	-	115 00	
	Cement - Contract #1088	160 bgs	.80	128 00	
	Sand - Contract #1094	100 yds	1.00	100 00	
	Stone - Contract #1096	120 yds	3.00	360 00	
	Labor - P.R.	-	-	375 00	
	Lumber for forms	1000	100 00	100 00	
					$1428 00
1110-c	12'-6" U.G.I. Water Gas Set - As per specification #291 on Contract #1169. Three shell type generators 12'-6" diam. Carburetter 12'-0" " Superheater 12'-0" diam. - Each equipped with oil steam and blast connections, etc. etc. - Voucher #2189	1 ech	19000 00	19000 00	19000 00
					$20888 00

Exhibit E—Actual size 11" x 8½"

surance cases, etc. Principally it will be helpful in re-appraising items of hidden value which cannot be found from a field inspection. This history should be complete in all its details and be compiled with due reference to the specifications, blue prints, etc., explaining the construction work. The form for correlating this information is shown as Exhibit "F." When the entire job has been completed and put into operation a card index form should be made out as shown on Exhibit "G." Each card should be used for one type of apparatus only, i.e., one card for pumps, one for generators, one for blowers, etc. This will be used as a ready index in order that any specific type of equipment can be located, together with all details as to erection costs, etc.

DISTRICT STATION Blank SHEET NO. 1

HISTORICAL RECORD OF WORK WORK ORDER NO. 1110

ACCOUNT NAME 318 - Water Gas Set

LOCATION

	DESCRIPTION	ACCOUNT NUMBER	REFERENCE TO DETAILED INV PAGE
	Give a complete history of the job referring to blue print contract specification and all other matter of an engineering nature which should be helpful at any future time if it becomes necessary to appraise the property on any basis whatever.		

Exhibit F—Actual size 11" x 8½"

Buildings are usually constructed by a contractor who bids a lump sum for the entire structure erected complete. In order to have a detailed inventory of all items of material entering into the building, it will be necessary for the inventory department to take off the quantities of materials, etc., from blue prints or from payment vouchers. From these blue prints, vouchers, etc., a detailed list of quantities, such as cubic yards of excavation, square yards of plastering, number of brick, etc., should be compiled following a general classification which is as follows:

Grading and Embankments
Piling
Excavation
Footings and Foundations
Walls
Structures, Steel and Iron
Roofing
Skylights
Partitions

Plaster
Floors and Ceilings
Windows
Doors and Gates
Galleries and Stairs
Miscellaneous Carpentry
  and Mill Work
Interior Finishing
Painting
Platforms

class of material to be removed without disturbing the balance and also allows for identification much more easily than if lump sum prices of a building were kept with a description of the building. If the building has been built for a lump sum contract price, the inventory department should price the various details en-

EQUIPMENT

CARD NO 1

CLASSIFICATION Water Gas Sets

MANUFACTURER	TYPE	SIZE	LOCATION	DATE INSTALLED	WORK ORDER REFERENCE NO
U.G.I. Co.	Three Shell	12'-6"	- Station	Aug.1923	1110

Exhibit G—Actual Size 11" x 8½"

Bins and Bunkers
Elevators and Dumbwaiters
Plumbing
Gas Fitting
Heating
Ventilating
Fire Protection
Electric Light and Wiring
Other Wiring
Trestles
Tracks
Smoke Stacks

An inventory set up in this manner gives a flexible segregation of building materials and allows any one section or tering into this building. This, of course, would be the duty of the engineer connected with the department and interviews with the contractor would be necessary as it would then become the duty of the contractor to assist the company in segregating the various items of cost under the proper classes of materials to which they belong. The details of the building should be entered upon final inventory summary form, Exhibit "E."

A description of the building, together with the historical record of its construc-

tion with references to blue prints, contracts, etc., should be written up on Exhibit "F." The building inventory record should also include a complete set of small maps or plats showing the location, size, etc., of buildings at each location.

A form for correlating the information pertaining to land is shown as Exhibit "H," and it will be found desirable to have a plat for each parcel of land.

One form should be used for each parcel and all details pertaining to its purchase and improvements, such as sidewalks, etc., should be included thereon. The final details of the land should then be transferred to the final inventory summary form, Exhibit "E."

* * * *

In compiling the inventory of street mains or distribution systems of a gas company, it is assumed that the company has a regular system of work orders and underlying forms covering the labor and material costs necessary to install the mains or distribution systems.

The principal elements in an inventory record of mains are the feet of pipe laid, the size, cost of fittings and the labor necessary to install. If the length of a main installed necessitates a number of days for completion, necessarily a lot of time and material tickets must be summarized to get the data necessary to compile the inventory. The correlation of this information has, no doubt, already been provided for by the gas companies, but in order to keep track of each piece of main installed, we have designed Exhibit "I." This form will allow for the correlation and description of the work. It also gives the complete details as to

LAND

DATE	PARCEL NUMBER	CITY RECORD	VOUCHER NUMBER	DESCRIPTION	COST	
5-2-23	1	Vol. 298 Folio 10 4-1-23	1290	(Give legal description of land)	$3,900	00
5-4-23			1298	Filing deeds, commissions, etc.	50	00
					$3,950	00

Exhibit H—Actual size 11" x 8½

STREET MAINS DATA SHEET

WORK ORDER NO. 2792
DATE LAID 5/25 TO 6/16/03
PREPARED BY
DATE
CHECKED BY

DESCRIPTION OF MAIN Cast Iron SIZE 6" LENGTH OF MAIN 5284'
JOINTS Lead Caulked NATURE OF SOIL Clay KIND OF PAVING None
TRENCH-LENGTH 5300' DEPTH 3'-6" WIDTH 2" POSITION Outside cartrack

NET MATERIAL USED – LESS RETURNS	WEIGHT IN LBS.	QUANTITY	PRICE PER LB. OR EACH	TOTAL
PIPE		5284'	.372	$ 1965 65
LEAD	3631		.04	145 26
CEMENT	-	-	-	-
YARN	135		.0375	5 07
LUMBER		990	.0075	7 43
COAL	520		.0035	1 30
CASTINGS (LIST)				
CASTINGS				
VALVES				
SMALL FITTINGS AS BELOW				
ELLS 1"		2	.03	06
ELLS				
STREET ELLS 1"		1	.03	03
STREET ELLS 1-1/2"		2	.055	11
REDUCING ELLS				
LONG THREADS				
COUPLINGS				
COUPLINGS				
REDUCERS				
BUSHINGS 1½ x 2"		1	.04	04
DRIP COUPLINGS 1" x 1½"		1	.10	10
NIPPLES 1½"		2	.07	14
NIPPLES				
PLUGS				
PLUGS				
CAPS 1"		2	.02	04
VALVES				
CORPORATION COCKS				
VALVE RODS				
STREET BOXES				
CEMENT				
WATER				
W I PIPE 1"		30'	.05	1 50
CASTINGS 6 x 6" Cross				18 00
6" Tee				17 61
MISCELLANEOUS MATERIAL				37 63
TOTAL COST OF MATERIAL				$ 2162 32

LABOR EMPLOYED

HOURS @	PER HOUR	
230	25	57 50
378	24½	92 61
613	20	122 60
2172	17½	380 10
11	22½	2 48
3404		

TOTAL LABOR 655 29

TOTAL COST OF MATERIAL AND LABOR $ 2817 61

NOTE ANY UNUSUAL CONDITIONS

PAVING CUT AND REPLACED
TOTAL LENGTH OF MAIN 5284 TOTAL COST $2817.61 COST PER FOOT $.5334

Exhibit I—Actual size 16" x 11"

STREET MAINS DATA SUMMARY

DISTRICT South

SIZE OF MAIN 6" TYPE C.I.

DATE	W O NUMBER	LENGTH OF MAIN	PIPE			LEAD		CEMENT		YARN		LUMBER		COAL		FITTINGS		MISCELLANEOUS		TOTAL MATERIAL	COST PER FOOT	LABOR			TOTAL COST	COST PER FOOT
			SIZE	LENGTH	COST	LBS	COST	AMT	COST	AMT	COST	AMT	COST	AMT	COST	AMT	COST		COST			HRS	TOTAL COST	COST PER HR		
6-16-03	2792	5284	6"		1965.65	3631	145.24	—		135	5.07	990	7.43	520	1.30	-	37.63			$2162.32		3404	$655.29		2817.61	.5324

Exhibit J—Actual size 16" x 11"

hours of labor and rates, together with all items of small fittings, etc., that are represented in a completed job. When this form has been completely filled out the information is then transferred to Exhibit "J," which is a street mains data summary sheet and is designed in such a manner as to give the complete details of any one job and also to take care of all jobs performed during the year. It gives

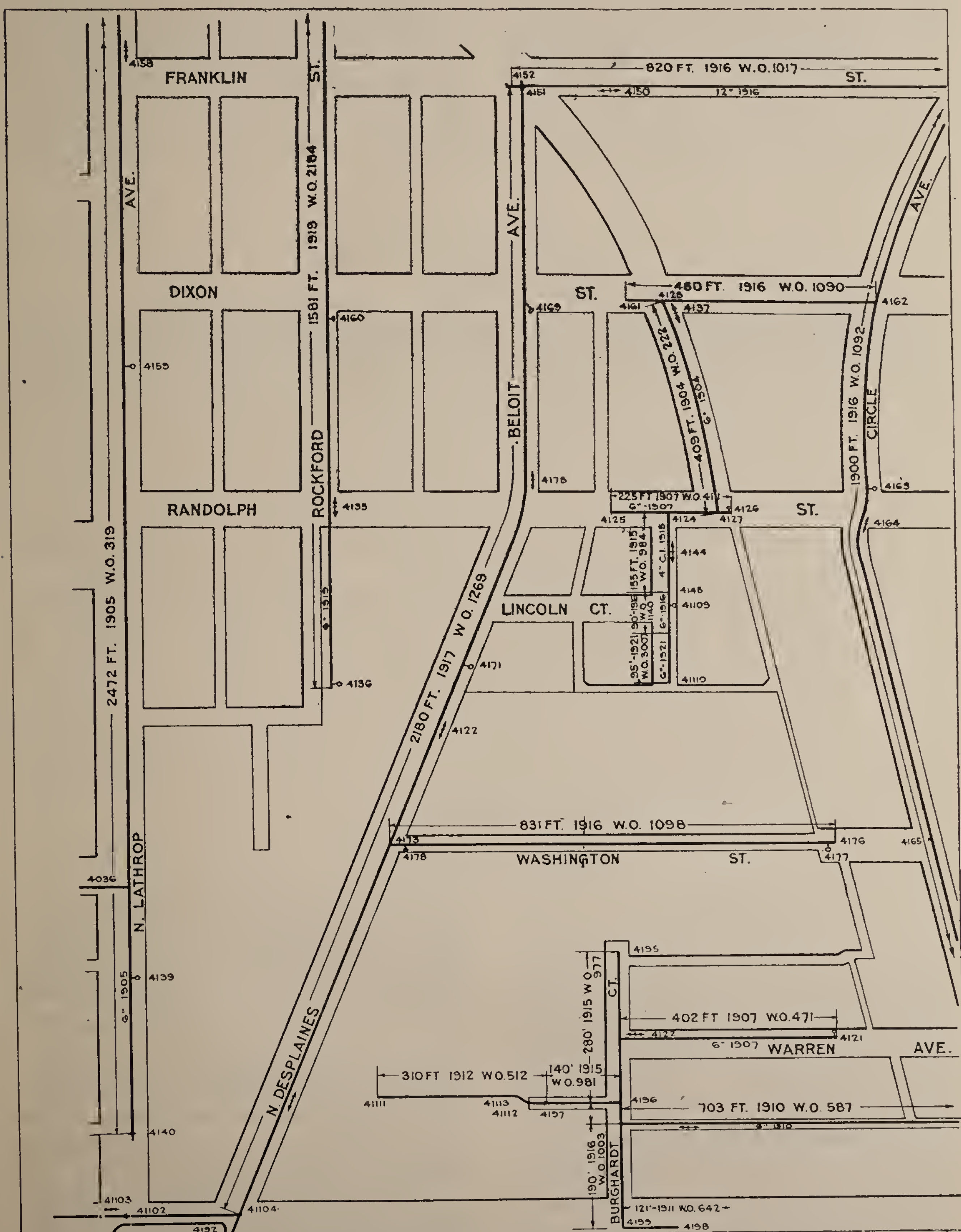


Exhibit K—Actual size 11" x 8½"

automatically the cost of each section of main installed complete, which is the information desired in order that mains abandoned may be taken out at their proper costs. Exhibit "J" should be used to correlate information by sizes of mains, a new form to be used for each size. The information as shown on Exhibit "J" can then be transferred by years for installing. One sheet should be used for one size of service. The information correlated on this form is then summarized and transferred to Exhibit "M." If a final summary of services is wanted the information should be transferred from Exhibit "M" to Exhibit "E," either by number of services or feet of pipe of various sizes together with the cost per foot

SERVICES MATERIAL AND LABOR

DETAIL COSTS

MONTH OF March

SIZE OF SERVICE 1¼"

DATE	ORDER NUMBER	LENGTH OF SERVICE	SIZE OF MAIN TAPPED	PIPE			CURB BOX			GOVERNOR			OTHER	TOTAL	LABOR		TOTAL COST
				AMOUNT	UNIT PRICE	COST	KIND	SIZE	COST	STYLE	SIZE	COST	MATL COST	MATL COST	TOTAL HOURS	TOTAL COST	OF SERVICE
3-2-23	2168	49	6"	49	.06	2.94	XYZ	-	2.50	None			1.10	6.54		14.70	21.20

Exhibit L—Actual size 11" x 8½"

or by months to the final inventory summary form, Exhibit "E."

In order to have a ready reference as to the dates mains were installed and the work orders under which they were installed, an atlas should be kept giving the information as shown on Exhibit "K."

The detailed information pertaining to services is correlated on Exhibit "L." This form gives the date installed, order number, length of the service, cost of the pipe, fittings, etc., together with the labor and the total cost of all services in the company property to the date of the summary. In order to properly identify each service a card index set up geographically by street and house number should be kept. This is shown as Exhibit "N." This card contains the size of the service, the location of the service, the size of the main tapped, the length of the various sections, together with their sizes and dates installed, and reference to order numbers, which allows the cost of the particular service to be readily located,

together with the necessary details that go to make up its installation.

Following the general method as outlined above, various forms can be designed which would take care of meters in service, vaults, paving over mains, miscellaneous furniture and fixtures, etc.

It should be borne in mind that the Uniform Classification of Accounts for Gas Utilities, as promulgated by the National Association of Railway and Utilities Commissioners, states in part as follows:

"Charges to specific accounts for tangible property cover direct labor and material costs up to and including the time of the foreman supervising the job; also such overhead expenditures for engineering, taxes during construction, etc., as can be allocated to definite items of property. Charges to overhead cost accounts should cover only expenditures of this nature which pertain to the enterprise as a whole and cannot be allocated to definite items of property."

The company desiring to install a system of continuous inventory should design a system which will automatically take care of the charges as outlined in the instructions in the classification.

In order to take care of the withdrawal of physical property, especially items of plant equipment and buildings, a system should be designed whereby the inventory department is notified that certain items of equipment are to be removed. This notification should go to the inventory department on a form similar to the request for a work order form. The inventory department should then go into the field and properly classify and inventory all items of equipment which are to be removed. When the inventory is com-

SERVICES
MONTHLY SUMMARY

MONTH OF March

SIZE OF SERVICE 1½"

ORDER NUMBER	LENGTH OF SERVICE	MATERIAL COST		MATERIAL COST PER FT.		LABOR COST		LABOR COST PER FT.		TOTAL COST COST		TOTAL COST COST PER FT	
2168	49	6	54		.143	14	70		.30	21	20		.443

Exhibit M—Actual size 11" x 8½"

pleted it should be properly identified from the original inventory record according to the information as shown in the detailed inventory. Where an item of equipment is removed, it should be removed from the inventory record and the cards or sheets pertaining thereto should likewise be removed and placed in a separate file for future reference. Simple field forms can be designed which will take care of inventorying the items of equipment, piping, buildings, etc., in the field removed from service. Mains; services and meters can be readily identified by reference to card indexes and maps and their original cost ascertained, and where such items are removed from the plant accounts it should be at the original cost.

Where a company has been in existence for a great many years and it is their intention to install a continuous inventory system, it would of necessity require that they make a complete inventory of their now existing property and set up in a manner similar to the way in which the final form, Exhibit "E," is filled out. This inventory should be priced on an original cost basis either actual or estimated.

Where an original inventory of a company's property is used as a base for a continuous system, then mains, services, meters, etc., withdrawn from service should be removed from the plant account at the average cost per foot of each, as the case may be, said average prices being computed from original appraisal and actual costs as determined by the continuous system.

It must be borne in mind that in taking out various items of equipment it is also necessary that the indirect items such as engineering, administration, etc., be deducted at the same time.

SERVICE

LOCATION 1120-E. Main

SIZE OF MAIN TAPPED 6"

	LENGTH	SIZE	DATE	ORDER NO.
MAIN TO CURB	12'	1½	3-2-23	2168
CURB TO L.L.	15'	"	"	"
L.L. TO HOUSE	22'	"	"	"

STYLE OF GOVERNOR None

CURBBOX - XYZ -

REMARKS: Through paving - Brick 2'-6" x 10'-8"

Exhibit N—Actual size 5" x 3"

METHOD OF KEEPING FIXED CAPITAL RECORD

E. L. Heyser, Philadelphia, Pa.

This exhibit contains a working example of keeping a "Fixed Capital Record," using forms designed for adoption by companies in which The United Gas Improvement Company is a shareholder. It is included in this report with the idea that it may be helpful to companies contemplating the installation of such a record.

The forms were designed to fit an inventory and appraisal which has been presented before, and accepted by, a state regulatory body, whose system of "Uniform Classification of Accounts" provides for accounts which are numbered, and described on the "Summary of Property," form 19, fig. 25.

The designer has endeavored to make the forms flexible enough to fit varying conditions, and properties serving from 1,500 or less, to 400,000 or more, consumers.

The number of accounts and sub-accounts and the quantity of blank forms to be carried in stock will vary according to the size of the property owned and operated by the Company adopting a "Fixed Capital Record," and the system of "Uniform Classification of Accounts" prescribed by the regulatory body having jurisdiction.

This working example has been prepared for illustration purposes only, and does not attempt to show all of the changes made to a property during a given period, but includes only one item of extension or addition and one item of retirement or removal for each of the major accounts, in order to keep the exhibit to a minimum size. Forms for all other miscellaneous items of property and sub-accounts can be patterned after those used for the major accounts.

Paper, 8½ x 11 inches in size, the standard business correspondence sheet, has been adopted as it can be cut from stock with a minimum amount of waste. It also fits the standard letter-sized, loose-leaf binder, for field work and office use, and standard filing devices.

The portion printed by long-hand represents the blank form, and the portion filled in by typewriter represents the work to be done by the Company's "Fixed Capital Record" division.

The headings and titles on the forms have been standardized as far as possible and, we believe, are self-explanatory. The "Page No." of each form is meant to show the number of pages used for each account, beginning with 1 and continuing consecutively for the number of sheets used for the various items of property installed during a given period.

Fig. 1, etc., on each working example sheet is not a part of the blank form or working example, but is only used for identification in the following description.

Description of Forms and Their Use

Forms 1 and 3, figs. 1 and 3, are requisitions for extensions and improvements, or repairs, which are sent to the Company's officials by the plant engineer, or superintendent, and provide for a complete description of, and the reasons for, the proposed extensions and improvements to the property, with the estimated cost of the work. The same forms are used for accounts 1 to 20, inclusive.

Forms 2 and 4, figs. 2 and 4, are used by the Company's officials in granting authority to make extensions and improvements, and are copies of the requisitions, except the text on the bottom of the face, which provides the authority. If the Company's officials do not approve the extensions or improvements, it is noted on the requisition and the plant engineer, or superintendent, notified.

Forms 1 and 3, figs. 1 and 3, are printed on white paper, and forms 2 and 4, figs. 2 and 4, are printed on colored paper, for quick identification between requisitions and authorizations.

Appropriations for the installation of new services, meters, meter connections and house governors, are provided for in the annual budget which is approved by the proper officials at the beginning of each fiscal year; therefore, no special form of requisition or authorization is needed, and installations are made when application for gas service is signed by the customer. Each installation is covered by a work order.

Form 5, figs. 5 and 6, has been designed for recording all land purchases and retirements chargeable to, or deductible from, accounts 1 to 4, inclusive. It provides for description, area, date of purchase or retirement, purchase price or cost from "Fixed Capital Record," and the administration, legal and accounting costs.

Form 6, figs. 8, 11 and 12, has been designed for recording all plant extensions chargeable to accounts 5 to 20, inclusive. It provides for description and quantity of materials, with date of purchase; and columns for various accounts, sub-accounts and total. If one sheet will not provide enough columns for sub-accounts necessary to record the construction of any item of property in detail, additional sheets are used and pages numbered consecutively.

Form 7, figs. 9 and 13, has been designed for recording all plant retirements now included in a permanent record and deductible from accounts 5 to 20, inclusive. It provides for a description of the item to be retired, date of retirement, source of cost, and the total cost, including administration, construction and accounting.

Form 8, figs. 7, 10, and 14, has been designed for summarizing accounts 1 to 20, inclusive. It provides for listing the cost or property account of any item from the "Fixed Capital Record" on the date established; the extensions to, and retirements from, the property in the account during a given period; and cost or property account of the same item as of a later date.

Form 9, fig. 15, has been designed to include all main authorizations completed during a given month, and provides columns for recording requisition and authorization numbers, size of pipe, location, length laid, length taken up or abandoned, etc. It acts as an identification record for all extensions to, and retirements from, all sizes of gas mains, account 21.

Form 10, fig. 16, has been designed for recording extensions of gas mains, account 21. It provides for requisition and authorization numbers, location, date, length and various detail costs. Separate sheet or sheets should be used for each size main.

Form 11, fig. 17, has been designed for recording retirements of gas mains now included in the "Fixed Capital Record" and deductible from account 21. It provides for requisition and authorization numbers, location, date of retirement, length, and various cost data. Separate sheet or sheets should be used for each size main.

Form 12, fig. 18, has been designed for summarizing gas mains, account 21. It provides for listing the cost of mains by sizes in ground, from the "Fixed Capital Record" on the date established; extensions to, and retirements from, mains during a given period; the cost of mains in ground as of a later date. Each column provides for length in feet and cost of each size main.

Form 13, fig. 19, has been designed for recording the installation of new gas services, account 22. It provides for listing work order numbers, location, date, and various statistical and cost data. Separate sheet or sheets should be used for each size.

Form 14, fig. 20, has been designed for recording the retirement or abandonment of services. It provides for listing work order numbers, location, date, size, and various other statistical and cost data. The retirements can be listed numerically by work order number, and summarized according to size, when desired.

Form 15, fig. 21, has been designed for summarizing gas services, account 22. It provides for listing size and type, number and cost of those in use from the "Fixed Capital Record" on the date established; number and cost of those installed and removed or abandoned during a given period, and the number and cost of those in use, as of a later date.

Form 16, fig. 22, has been designed for summarizing gas meters, account 23. It provides for listing meters by size, giving number and cost of those owned, from the "Fixed Capital Record" on date established; number and cost of those purchased and condemned during a given period, and the number and cost of those owned, as of a later date.

Form 17, fig. 23, has been designed for summarizing meter connections, account 24. It provides for listing meters by size, giving number and cost of those owned and in use from the "Fixed Capital Record" on date established, the number and cost of those installed and removed during a given period, and the number and cost of those in use as of a later date.

Form 18, fig. 24, has been designed for summarizing house governors, account 25. It provides for listing house governors by make and size, giving number and cost of those in use from the "Fixed Capital Record" on date established, the number and cost of those installed during a given period, and the number and cost of those in use as of a later date.

Most gas companies have complete detailed records of meters, meter connections and house governors, kept by the Distribution Department, from which the summaries can be prepared without additional detailed work by the "Fixed Capital Record" division.

Form 19, fig. 25, is designed for summarizing the cost of an entire property as of any date desired. It includes the num-

ber and title of each account and provides for the cost of each account which is obtained from the "Fixed Capital Record," except where extensions or retirements have been made, in which cases, the "Total Cost" is obtained from the "Summary" of the accounts, prepared and recorded by the "Fixed Capital Record" division.

It is thought that this form can be filled in periodically by the person in charge of the "Fixed Capital Record" division, and handed to the chief executive of the company who can use it and the monthly operating statement in discussing rate structures or other financial matters with municipal or state authorities and the company's executive board.

Name of Company
City or Town

REQUISITION FOR IMPROVEMENTS OR REPAIRS

NO. 2
DATE March 2, 1928.
Form No. 1

TITLE . New Boiler

DISTRICT

Description of Work to be Done

Replace old 125 H. P. Boiler with new 180 H.P. Boiler
(Same size with greater number of tubes)

CLASSIFICATION OF ACCOUNTS		RECOMMENDED BY
ACCOUNT TO BE CHARGED Boiler Equipment		DATE
Accounts into which Auth. is to be closed:	Amount	ENTERED IN REQ. RECORD
Miscel. Works	$ 4,000	AUTH. No. 2
Operating	2,832	
Total Amount for Approval (See other side for detailed estimate)	$ 6,832	

ARGUMENT OR REASONS FOR RECOMMENDING THE EXPENDITURE

The old boiler has been condemned by the Boiler Inspector.

The reserve boiler now seventeen years old was damaged some years ago by a bad bag. It was necessary to patch the shell at that time and since then the patch has given a great deal of trouble. A recent report of the Insurance Company recommends that the boiler be replaced by a new boiler, owning to the difficulty and expense of replacing sheets on the existing boiler, which is necessary in order to do away with the troublesome patch which has been condemned.

(1) SEE OTHER SIDE

John Brown.
Plant Engineer.

Fig. 1 (front)

DETAILED ESTIMATE OF COST					
ITEM NO.	DETAIL	QUANTITY	UNIT	UNIT COST	TOTAL COST
	72" x 19'-6" H.R.T. Boiler with Castings and Fittings				$ 2,085.00
	Flue -				325.00
	(Bid)--D. M. Dillon Steam Boi. Co. - Material & ~~Labor Setting~~ Boiler				1,100.00
	(Bid) L. H. Shattrick Co.				
	Sundries				351.00
	Grates				760.00
	Fire Brick				900.00
	Labor & Superintendence				1,311.00
					$ 6,832.00
	TOTAL ESTIMATED COST				$ 6,832.00

(2) SEE OTHER SIDE

Fig. 1 (reverse)

Name of Company
City or Town

REQUISITION FOR IMPROVEMENTS OR REPAIRS

No. 2
DATE March 2, 1922.
Form No. 2

TITLE New Boiler

DISTRICT

Description of Work to be Done

Replace old 125 H.P. Boiler with new 180 H.P. Boiler
(Same size with greater number of tubes)

CLASSIFICATION OF ACCOUNTS

ACCOUNT TO BE CHARGED Boiler Equipment

Accounts into which Auth. is to be closed:	Amount
Misc. Works	4,000
Operating	2,832
Total Amount for Approval (See other side for detailed estimate)	$ 6,832

REMARKS:

AUTHORIZATION

You are hereby authorized to proceed with the work as outlined in the above requisition, at a cost not to exceed the amount for approval indicated thereon.

The work will be done under AUTH. NO. 2 DATED 4-2-22

James Smith
General Superintendent.

(1) SEE OTHER SIDE

Fig. 2 (front)

DETAILED ESTIMATE OF COST

ITEM NO.	DETAIL	QUANTITY	UNIT	UNIT COST	TOTAL COST
	72" x 19'-6" H.R.T. Boiler with Castings and Fittings -				$ 2,085.00
	Flue (Bid) - D.M. Dillon Steam Boi. Co.				325.00
	Material & Labor Setting Boiler (Bid) H. L. Shattrick Co.				1,100.00
	Sundries				351.00
	Grates				760.00
	Fire Brick				900.00
	Labor & Superintendence				1,311.00
	TOTAL ESTIMATED COST				$ 6,832.00

(2) SEE OTHER SIDE

Fig. 2 (reverse)

GAS DEPT. REQUISITION FOR STREET MAINS	Name of Company City or Town	DATE 4-1-23	No.3 Form No.3
DISTRICT		SIZE OF PIPE 6"	

NAME OF STREET	Maple			
FROM	10th Street			
TO	11th Street			
LENGTH IN FEET	600			
RUNNING N. S. E. OR W.	East			
NATURE OF GROUND	Rock			
STREET GRADED? PAVED?	Paved			
CONNECTING WITH OLD MAIN AT	10th & Maple St.			
SIZE OF OLD MAIN	8"			
MAIN TO BE TAKEN UP OR ABANDONED LENGTH IN FEET	600			
SIZE	2"			

ESTIMATED NEW BUSINESS DUE TO THIS EXTENSION

CLASS OF CONSUMER	Total No. of Houses and Stores Along Line of This Extension	FIRST YEAR			SECOND YEAR		
		Number of Consumers	Consumption Per Consumer	Total Consumption	Number of Consumers	Consumption Per Consumer	Total Consumption
A							
B							
C							
STREET LAMPS							
TOTAL							

CLASSIFICATION OF ACCOUNTS

Accounts into which Auth. is to be closed:	Amount
Total Amount (See other side for Detailed Estimate)	
Less Contributed toward Cost of Extension for which there will be no refund.	
Amount for Approval	1,224.00

RECOMMENDED BY

DATE

ENTERED IN REQ. RECORD

AUTH. No. 3

ARGUMENT OR REASONS FOR RECOMMENDING THE EXPENDITURES

(1) See other side

John Brown
Plant Engineer.

Fig. 3 (front)

DETAILED ESTIMATE OF COST

	SIZE OF PIPE	LENGTH IN FEET	COST PER FOOT	TOTAL COST
MATERIAL (Pipe and Specials)	6"	600	1.39	834.00
LABOR			.46	275.00
PAVING			.192	115.00
TOTAL COST OF MAIN			2.042	1,224.00

METERS	@	PER METER	
SERVICES	@	PER SERVICE	
GOVERNORS	@	PER GOVERNOR	
	@	PER	
TOTAL COST OF MAINS, METERS AND SERVICES—1st YEAR			
METERS Additional 2nd Year	@	PER METER	
SERVICES " "	@	PER SERVICE	
GOVERNORS " "	@	PER GOVERNOR	
	@	PER	
TOTAL COST OF MAINS, METERS AND SERVICES—2nd YEAR			

ADDITIONAL INFORMATION REQUIRED

IF AHEAD OF PERMANENT PAVING, STATE HOW LONG IT WILL BE BEFORE MAIN WILL BE REQUIRED FOR BUSINESS OR PRESSURE PURPOSES.

IF FOR A REPLACEMENT OF SMALL MAIN TO BE TAKEN UP OR ABANDONED, STATE NUMBER OF CONSUMERS NOW CONNECTED TO OLD MAIN AND TOTAL ANNUAL CONSUMPTION ESTIMATED FROM THESE CONSUMERS.

IS MAIN EXTENSION REQUIRED BY FRANCHISE OR LOCAL ORDINANCE?
IF SO, GIVE DETAILS.

TOTAL AMOUNT TO BE CONTRIBUTED TOWARDS COST OF EXTENSION $
AMOUNT OF CONTRIBUTION THAT WILL NOT BE REFUNDED $
BALANCE OR AMOUNT OF CONTRIBUTION TO BE REFUNDED $
GIVE BASIS OF REFUND

REMARKS OR ADDITIONAL ARGUMENT OR REASONS FOR RECOMMENDING EXPENDITURE
If Sketch is Required Use This Space

(2) See Other Side

Fig. 3 (reverse)

Name of Company

GAS DEPT. City or Town No. 3

REQUISITION FOR STREET MAINS DATE 4-1-23 FORM No. 4

DISTRICT SIZE OF PIPE 6"

NAME OF STREET	Maple			
FROM	10th Street			
TO	11th Street			
LENGTH IN FEET	600			
RUNNING N. S. E. OR W.	East			
NATURE OF GROUND	Rock			
STREET GRADED? PAVED?	Paved			
CONNECTING WITH OLD MAIN AT	10th & Maple St.			
SIZE OF OLD MAIN	8"			
MAIN TO BE TAKEN UP OR ABANDONED LENGTH IN FEET	600			
SIZE	2"			

ESTIMATED NEW BUSINESS DUE TO THIS EXTENSION

CLASS OF CONSUMER	Total No. of Houses and Stores Along Line of This Extension	FIRST YEAR			SECOND YEAR		
		Number of Consumers	Consumption Per Consumer	Total Consumption	Number of Consumers	Consumption Per Consumer	Total Consumption
A							
B							
C							
STREET LAMPS							
TOTAL							

CLASSIFICATION OF ACCOUNTS

Accounts into which Auth. is to be closed:	Amount
Total Amount (See other side for Detailed Estimate)	
Less Contributed toward Cost of Extension for which there will be no refund.	
Amount for Approval	1,224.00

AUTHORIZATION

You are hereby authorized to proceed with the work as outlined in the above Requisition, at a cost not to exceed the amount for approval indicated thereon.

The work will be done under AUTH. NO. 3 DATED 4-25-23

James Smith
General Superintendent.

(1) See other side

Fig. 4 (front)

DETAILED ESTIMATE OF COST

	SIZE OF PIPE	LENGTH IN FEET	COST PER FOOT	TOTAL COST
MATERIAL (Pipe and Specials)	6"	600	1.39	834.00
LABOR			.46	275.00
PAVING			.192	115.00
TOTAL COST OF MAIN			2.042	1,224.00

METERS	@	PER METER	
SERVICES	@	PER SERVICE	
GOVERNORS	@	PER GOVERNOR	
	@	PER	
TOTAL COST OF MAINS, METERS AND SERVICES—1st YEAR			
METERS Additional 2nd Year	@	PER METER	
SERVICES " "	@	PER SERVICE	
GOVERNORS " "	@	PER GOVERNOR	
	@	PER	
TOTAL COST OF MAINS, METERS AND SERVICES—2nd YEAR			

ADDITIONAL INFORMATION REQUIRED

IF AHEAD OF PERMANENT PAVING, STATE HOW LONG IT WILL BE BEFORE MAIN WILL BE REQUIRED FOR BUSINESS OR PRESSURE PURPOSES.

IF FOR A REPLACEMENT OF SMALL MAIN TO BE TAKEN UP OR ABANDONED, STATE NUMBER OF CONSUMERS NOW CONNECTED TO OLD MAIN AND TOTAL ANNUAL CONSUMPTION ESTIMATED FROM THESE CONSUMERS.

IS MAIN EXTENSION REQUIRED BY FRANCHISE OR LOCAL ORDINANCE?
IF SO, GIVE DETAILS.

TOTAL AMOUNT TO BE CONTRIBUTED TOWARDS COST OF EXTENSION $
AMOUNT OF CONTRIBUTION THAT WILL NOT BE REFUNDED $
BALANCE OR AMOUNT OF CONTRIBUTION TO BE REFUNDED $
GIVE BASIS OF REFUND

REMARKS OR ADDITIONAL ARGUMENT OR REASONS FOR RECOMMENDING EXPENDITURE
If Sketch is Required Use This Space

(2) See Other Side

Fig. 4 (reverse)

Fig 5

Name of Company

City or Town

LAND - Extension
ACCOUNT NO. 1
LOCATION - Gas Works
REQUISITION NO. 1
AUTHORIZATION NO. 1

PAGE NO 1
COMPILED BY
ENTERED ON SUMMARY BY
DATE 1/1/23
FORM NO 5

DESCRIPTION	DATE	COST
		$
Parcel of Land purchased from John Doe Estate containing 100,000 sq. ft. Having a frontage of 500 ft. on Amory St. and 200 ft. on Youville Street.	Jan. 1,1923	50,000
Administrative, Legal and Accounting Costs.		9.500
TOTAL		$ 59,500

Fig 6

Name of Company

City or Town

LAND Retirement
ACCOUNT NO. 1
LOCATION Gas Works Land
REQUISITION NO. 1
AUTHORIZATION NO. 1

PAGE NO. 1
COMPILED BY
ENTERED ON SUMMARY BY
DATE 1/1/22
FORM NO. 5

DESCRIPTION	DATE	COST
		$
Old Reservoir Site, extending 400 feet on M. & L. R. R. and 217.8 feet on Calef Road, having an area of 87,120 square feet, including Administration, Legal and Accounting Costs - from Appraisal as of 7-1-21	1-1-22	6,545.31
TOTAL -		$ 6,545.31

FIG 7

Name of Company

City or Town

SUMMARY OF ACCOUNT NO. 1
SUBJECT. Gas Works Land

PAGE NO 1
COMPILED BY. [illegible]
ENTERED ON SUMMARY BY. J.E.H.
DATE 6-3-23
FORM NO 8

COLUMN 1		COLUMN 2		COLUMN 3		COLUMN 4 = (1+2)-3	
PROPERTY		EXTENSIONS		RETIREMENTS		PROPERTY	
DATE	COST	COST	PAGE NO	COST	PAGE NO	DATE	COST
	$	$		$			$
7-1-21	110,000.25	59,500	1	6,545.31	1	5/1/23	162,954.94

FIG 8

PLANT EXTENSION
ACCOUNT NO 8
SUBJECT - Purifier House #14
LOCATION - Gas Works
REQUISITION NO. 7
AUTHORIZATION NO 7

Name of Company

City or Town

PAGE NO 1
COMPILED BY. [illegible]
ENTERED ON SUMMARY BY [illegible]
DATE 1/10/23
FORM NO 6

ITEM	UNIT & QUANTITY OF MATERIAL	DATE	FOUNDATION		WALLS		ROOF		MILLWORK		MISC.		TOTAL
			MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR	
			$	$	$	$	$	$	$	$	$	$	$
Excavating Labor	11.6 yd.	1-1-23		18.33									
Concrete Materials	8.7 "		86.30	10.70									
Formwork	312□ft.		18.10	38.69									
Backfilling	2.9 yd.			1.33									
Brickwork	12.826M				467.38	311.54							
1" Rough Sheathing	.359MBF						19.82	11.11					
3" x 4" Rafters	.185 "						12.99	8.56					
2" x 4" Top Plates	.162 "						12.78	8.42					
Removable Section - 1" T. & G.	.228 "						25.17	9.11					
Barrett Specification Roofing	587□ft.						64.57	23.48					
Single Swing Mill Const. Batten Door 1" T.&G. 2'x5'-9"	1 Pc.								11.09	8.03			
Steel Lintels - 3"x3" Angles	320 lb.										13.22	5.66	
TOTAL			104.40	69.05	467.38	311.54	135.33	60.68	11.09	8.03	13.22	5.66	1186.38
Administration, Construction & Accounting Costs													219.48
Total -													1405.86

FIG 9

Name of Company

City or Town

PLANT RETIREMENT-
ACCOUNT NO- 8
SUBJECT- Coal Crusher Framing #50
LOCATION- Gas Works
REQUISITION NO 8
AUTHORIZATION NO 8

PAGE NO 1
COMPILED BY
ENTERED ON SUMMARY BY
DATE 1/21/23
FORM NO 7

DESCRIPTION	DATE	COST OBTAINED FROM	TOTAL COST
Coal Crusher Framing #50 - This was a timber frame work with hopper used as a support for coal crushing machinery- General Dimensions: 9'-4" x 9'-2" out to out of columns, and 21'-3" from ground to peak of roof; located on the north side of the Generator House. - Including Administration, Construction & Accounting Costs -	1-1-23	Appraisal as of 7-1-21	$ 268.16
TOTAL -			$ 268.16

FIG 10

Name of Company

City or Town

SUMMARY OF ACCOUNT NO. 8
SUBJECT General Works Structures

PAGE NO. 1
COMPILED BY
ENTERED ON SUMMARY BY. J.E.H.
DATE 6-3-23
FORM NO 8

COLUMN 1 PROPERTY		COLUMN 2 EXTENSIONS		COLUMN 3 RETIREMENTS		COLUMN 4 = (1+2)-3 PROPERTY	
DATE	COST	COST	PAGE NO.	COST	PAGE NO.	DATE	COST
7-1-21	$ 105,260.30	$ 1,405.86	1	$ 268.16	1	6/1/23	$ 106,398.00

FIG 11

PLANT EXTENSION
ACCOUNT NO. 10
SUBJECT - Boiler Installation
LOCATION - Gas Works Bldg. #9
REQUISITION NO 2
AUTHORIZATION NO 2

Name of Company

City or Town

PAGE NO. 1
COMPILED BY
ENTERED ON SUMMARY BY
DATE 3/7/23
FORM No 6

ITEM	UNIT & QUANTITY OF MATERIAL	DATE	FOUNDATION		SETTING		APPARATUS		PIPE & F'T'GS		MISC.		TOTAL
			MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR	
			$	$	$	$	$	$	$	$	$	$	$
Labor		3/2/22		210.34									
Portland Cement	10 bbl.		32.51										
Lumber			52.59										
Frt. & Cartage			.56										
Labor						490.34							
80 Cartons Sil-O-Cil Brick	16000#				193.05								
Foote Back Combustion Chamber Arch 24x28 with Clevis, 1 bag of asbestos -	1 Pc.				47.78								
Blowoff pipe protector stacks	10 Pc.				19.60								
Bald Eagle Brick	1500Pc.				105.39								
German Fire Clay	2000#				10.34								
Johns-Maneville Cement	1000#				51.77								
Blocks - 6" x 36"	100Pc.				36.00								
3-Bags J.M.85% Mag. Cement	188#				9.00								
Felt Cement 100# Bags					8.00								
Lehigh Cement in paper	7½ #				24.38								
Lumber					31.25								
Frt. & Cartage					55.05								
Labor								586.23					
Perfect Hand Stoker 72" x 72"	1 Pc.						475.92						
Keg Armoroote 196-16	180#						23.40						
Cutting Breeching								10.50					
72" H.R.T. Boiler	1 Pc.						1852.00						
Flue	1 Pc.						325.00						
Machine Work on Flue							30.88						
Erecting Flue								133.04					
#9 - 24" Argand Steam Blower	1 Pc.						70.00						
216' of 2x2x¼ Angle	689#						20.19						
Planing Plates							4.05						
Bolts and Washers							11.32						
Amount Carried Forward			85.66	210.34	591.61	490.34	2812.76	729.77					

FIG. 12

PLANT EXTENSION
ACCOUNT NO. 10
SUBJECT - Boiler Installation
LOCATION - Gas Works Bldg. #9
REQUISITION NO. 2
AUTHORIZATION NO. 2

Name of Company

City or Town

PAGE NO. 2
COMPILED BY
ENTERED ON SUMMARY BY
DATE 3/7/23
FORM NO. 6

ITEM	UNIT & QUANTITY OF MATERIAL	DATE	FOUNDATION		SETTING		APPARATUS		PIPE & F'T'GS		MISC.		TOTAL
			MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR	
- Amount Brought Forward -			85.66	210.34	591.61	490.34	2812.76	729.77					
Bars Steel	4 Pc.						7.57						
10" Sheet Lead	106½#						9.50						
Benjamin 3-Socket & 250 Nitrogen Lt.	1 Pc.						3.75						
Machine Work							12.50						
Safety Valve Box							9.02						
Machine Work - 4 Bolts							3.28						
Bolts	100 Pc						.21						
Lumber							47.50						
Frt. & Cartage							2.76						
Labor										41.14			
6" Foster Auto Non-Return Boiler Stop Valve Angle Pattern	1 Pc.								145.00				
Miscellaneous											3.59		
2" Brass Steam Swing Joint	2 Pc.								16.85				
Fittings & Labor										129.42			
6" J.M. Standard 85% Mag. P. Cover'g	18 ft.								5.76				
Fittings - Storeroom									2.12				
8" J.M. Std. 85% Mag. Pipe Cover'g	18 ft.								7.92				
6" Ex.Heavy Flg. Steel Offset 4½" 3'-6" Face to Face	1 Pc.								37.00				
6" Ex.Heavy Flg. Ftg. 10-3/8"F. to F.	1 Pc.								12.70				
6" " " " " 90° Elbow	1 Pc.								9.38				
8" Lead	35#								3.27				
1¼" Vertical Ball Check Valve	1 Pc.								5.81				
1¼ x 2 Brass Nipe	3 Pc.								.75				
Frt. & Cartage									1.86				
Total -			85.66	210.34	591.61	490.34	2908.85	729.77	248.42	170.56	3.59		5,439.14
Administration, Construction & Accounting Costs -													1,006.24
TOTAL - -													6,445.38

FIG. 13

Name of Company

City or Town

PLANT RETIREMENT
ACCOUNT NO 10
SUBJECT Boiler Removal
LOCATION Works Building #9
REQUISITION NO. 2
AUTHORIZATION NO. 2

PAGE NO 1
COMPILED BY [initials]
ENTERED ON SUMMARY BY [initials]
DATE 3/16/23
FORM NO. 7

DESCRIPTION	DATE	COST OBTAINED FROM	TOTAL COST
			$
1 - 125 H.P. Cunningham Iron Co. Horizontal Tubular Boiler - 72" x 18'-0": - 118 - 3" Tubes - Steam Pressure 115# - Installed 1906 - Auth. 291 - Including Administration, Construction & Accounting Costs Foundation for the above boiler not removed -	3/2/22	Appraisal as of 7-1-21	2,496.18
TOTAL -			$ 2,496.18

FIG 14

Name of Company

City or Town

SUMMARY OF ACCOUNT NO. 10
SUBJECT.- Boiler Plant

PAGE NO. 1
COMPILED BY [initials]
ENTERED ON SUMMARY BY J.E.K.
DATE. 6-3-23
FORM NO 8

COLUMN 1		COLUMN 2		COLUMN 3		COLUMN 4 = (1+2)-3	
PROPERTY		EXTENSIONS		RETIREMENTS		PROPERTY	
DATE	COST	COST	PAGE NO.	COST	PAGE NO.	DATE	COST
	$	$		$			$
7-1-21	75,000.00	6,445.38	1	2,496.18	1	6/1/23	78,949.20

FIG 15

Name of Company

City or Town

MAINS
ACCOUNT NO. 21

REPORT OF ALL STREET MAIN EXTENSIONS
AND IMPROVEMENTS COMPLETED
DURING MONTH OF April, 1923.

PAGE NO. 1
COMPILED BY
ENTERED ON DETAIL SHEET BY
DATE. 5/3/23
FORM NO 9

REQ. NO.	AUTH NO.	SIZE OF PIPE	KIND	STREET	SIDE OF STREET	FROM	TO	LENGTH LAID IN FEET	NATURE OF GROUND	TAKEN UP OR ABANDONED	
										LENGTH	SIZE
3	3	6"	C.I.	Marple	West	100' W. of 10th St.	W. Curb of 11th St	600	Rock	600	2"

FIG 16

Name of Company

City or Town

MAIN EXTENSIONS
ACCOUNT NO 21
SIZE 6" KIND Cast Iron

PAGE NO 2
COMPILED BY
ENTERED ON SUMMARY BY
DATE 5/3/23
ENTERED ON STREET MAIN MAP & BOOK BY
FORM NO. 10

REQ. NO.	AUTH. NO	PAGE NO. FORM #9	LOCATION	DATE	LENGTH	LABOR	PIPE AND SPECIALS	SUNDRIES	COST		PAVING		TOTAL COST
									TOTAL	PER FOOT	MATERIAL	LABOR	
						$	$	$	$	$	$	$	$
3	3		Maple St.-10th to 11th Sts.	4-30-23	600'	275.00	775.00	59.00	1109.00	1.85		115.00	1224.00
TOTAL - including Administration, Construction & Accounting Costs					600				1109.00	1.85		115.00	1224.00

FIG 17

Name of Company

City or Town

MAIN RETIREMENTS
ACCOUNT NO. 21
SIZE 2" KIND Steel

PAGE NO 1
COMPILED BY
ENTERED ON SUMMARY BY
DATE 5/3/23
ENTERED ON STREET MAIN MAP & BOOK BY
FORM NO 11

REQ. NO.	AUTH NO	PAGE NO FORM #9	DESCRIPTION	DATE	LENGTH	COST OBTAINED FROM	UNIT COST	TOTAL COST
3	3	1	Main Abandoned on Maple St. - 10th to 11th Sts.	4-30-23	600	Appraisal as of 7-1-21	$ .38	$ 228.00
TOTAL - including Administration, Construction & Accounting Costs -					600			228.00

FIG 18

MAINS - SUMMARY
ACCOUNT NO 21

Name of Company

City or Town

PAGE NO. 1
COMPILED BY
ENTERED ON SUMMARY BY J.E.H.
DATE 6-3-23
FORM NO 12

SIZE & KIND	COLUMN 1 MAINS IN GROUND AS OF July 1, 1921		COLUMN 2 LAID FROM 7-1-21 TO 6-1-23		COLUMN 3 ABANDONED FROM 7-1-21 TO 6-1-23		COLUMN 4 = (1+2) - 3 MAINS IN GROUND AS OF 6-1-23	
	FEET	COST	FEET	COST	FEET	COST	FEET	COST
CAST IRON		$		$		$		$
3"	74122	30,647.00					74,122	30,647.00
4"	194785	112,685.62					194,785	112,685.62
6"	92427	69,454.00	600	1109.00			93,027	70,563.00
8"	24792	23849.00					24,792	23,849.00
10"	17521	21,876.00					17,521	21,876.00
12"	9647	14,878.00					9,647	14,878.00
16"	1346	2,923.00					1,346	2,923.00
20"	729	2,144.00					729	2,144.00
24"								
30"								
STEEL								
1½" & UNDER	47887	17,989.00			600	228.00	47,287	17,761.00
3"								
4"								
6"								
8"								
10"								
12"								
TOTAL - including Administration, Construction & Accounting Costs -							463,256	297,326.62

FIG 19

Name of Company

City or Town

NEW SERVICE
ACCOUNT NO 22
SIZE 1½" TYPE Full

PAGE NO 1
COMPILED BY
ENTERED ON SUMMARY BY
DATE 1/10/23
FORM NO 13

WORK ORDER NO.	STREET & NUMBER	DATE	LENGTH	COCK OR VALVE	BOX	KIND OF PIPE	LOCATION OF MAIN & SIZE	LABOR COSTS	PIPE AND FITTINGS	SUNDRIES	TOTAL	PAVING		TOTAL COST
												MATERIAL	LABOR	
								$	$	$	$	$	$	$
2796	712 State St.	1-1-23	33'-6"	Yes	Yes	Galv.	6" C.I.-4'-6" E. of W. Curb	5.00	6.00	.35	11.35		2.00	13.35
TOTAL - including Administration, Construction & Accounting Costs											$ 11.35		$ 2.00	$ 13.35

FIG 20

Name of Company

City or Town

SERVICE RETIREMENT
ACCOUNT NO. 22

PAGE NO. 1
COMPILED BY
ENTERED ON SUMMARY BY
DATE 1/10/23
FORM NO. 14

WORK ORDER NO	STREET & NUMBER	DATE	SIZE	TYPE	LENGTH	COCK OR VALVE	BOX	COST OBTAINED FROM	UNIT COST	TOTAL COST
									$	$
2797	610 West St.	1-1-23	3/4"	Full	30'-0"	¾" Cock	Yes	Appraisal as of 7-1-21	.16	4.80
TOTAL - including administration, construction & accounting costs										$ 4.80

FIG. 21

Name of Company

City or Town

SERVICES - SUMMARY
ACCOUNT NO. 22

PAGE NO. 1
COMPILED BY - [initials]
ENTERED ON SUMMARY BY - J.E.H.
DATE - 6-3-23
FORM NO 15

SIZE	TYPE	COLUMN 1 — IN USE AS OF July 1, 1921 — NUMBER	COST	COLUMN 2 — INSTALLED FROM 7-1-21 TO 6-1-23 — NUMBER	COST	COLUMN 3 — REMOVED FROM 7-1-21 TO 6-1-23 — NUMBER	COST	COLUMN 4 = (1+2)-3 — IN USE AS OF 6-1-23 — NUMBER	COST
3/4"	FULL	8	19.46			1	4.80	7	14.66
1"		4656	36,976.41					4656	36,976.41
1¼"		2952	30,314.82	1	13.35			2953	30,328.17
1½"		229	3,192.10					229	3,192.10
2"		113	1,359.85					113	1,359.85
3"		2	32.07					2	32.07
4"		3	104.66					3	104.66
6"		1	3.38					1	3.38
3/4"	CURB								
1"									
1¼"									
1½"									
3/4"	EXTENSION								
1"									
1¼"									
1½"									
2"									
3"									
4"									
6"									
	TOTAL	- including Administration, Construction & Accounting Costs -						7,964	72,012.30

FIG. 22

Name of Company

City or Town

METERS - SUMMARY
ACCOUNT NO. 23

PAGE NO. 1
COMPILED BY. [initials]
ENTERED ON SUMMARY BY. J.E.H.
DATE 6-3-23
FORM NO 16

TYPE & SIZE	COLUMN 1 — METERS OWNED AS OF July 1, 1921 — NUMBER	COST	COLUMN 2 — METERS PURCHASED FROM 7-1-21 TO 6-1-23 — NUMBER	COST	COLUMN 3 — METERS CONDEMNED FROM 7-1-21 TO 6-1-23 — NUMBER	COST OBTAINED FROM APPRAISAL AS OF 7-1-21 — UNIT	TOTAL	COLUMN 4 = (1+2)-3 — METERS OWNED AS OF 6-1-23 — NUMBER	COST
		$		$		$	$		$
ORDINARY									
3 LT	3258	14760.04			25	4.53	113.25	3233	14,646.79
5	11692	64915.15	350	3600.00				12042	68,415.15
10	301	2211.65						301	2,211.65
20	99	1138.75						99	1,138.75
30	64	1116.03						64	1,116.03
45	11	293.56						11	293.56
60	8	276.65						8	276.65
100	45	2469.71						45	2,469.71
150	12	1001.80						12	1,001.80
200	3	315.54						3	315.54
5A	53	324.89						53	324.89
10A	210	2450.28						210	2,450.28
30A	51	1075.94						51	1,075.94
150A									
PREPAYMENT									
3 LT.	6	44.17						6	44.17
5	386	3134.90						386	3,134.90
10	30	325.23						30	325.23
5A									
10A									
Grand Total - including Administration, Construction & Accounting Costs -								16,554	$99,241.04

FIG 23

Name of Company

City or Town

METER CONNECTIONS - SUMMARY
ACCOUNT NO. 24

PAGE NO. 1
COMPILED BY
ENTERED ON SUMMARY BY J.E.H
DATE 6-3-23
FORM NO 17

SIZE OF METER AND TYPE OF CONNECTION	COLUMN 1 IN USE AS OF 7-1-21 NUMBER	COST	COLUMN 2 INSTALLED FROM 7-1-21 TO 6-1-23 NUMBER	COST	COLUMN 3 REMOVED FROM 7-1-21 TO 6-1-23 NUMBER	COST OBTAINED FROM Appraisal as of 7-1-21 UNIT	TOTAL	COLUMN 4 = (1+2)-3 IN USE AS OF 6-1-23 NUMBER	COST
Iron Conn.		$		$		$	$		$
3 Lt.	3107	5975.76			25	1.92+	48.08	3082	5927.68
5 "	11676	22513.64	35	105.00				11711	22618.64
10 "	256	701.43						256	701.43
20 "	63	256.05						63	256.05
30 "	38	185.55						38	185.55
45 "	5	29.97						5	29.97
60 "	2	19.10						2	19.10
100 "	12	114.13						12	114.13
150 "	9	85.41						9	85.41
200 "	2	18.98						2	18.98
5-A	48	167.72						48	167.72
10-A	192	612.99						192	612.99
30-A	39	378.55						39	378.55
Grand Total - including Administration, Construction & Accounting Costs -								15,459	$ 31,116.20

FIG 24

Name of Company

City or Town

HOUSE GOVERNORS - SUMMARY
ACCOUNT NO 25

PAGE NO 1
COMPILED BY
ENTERED ON SUMMARY BY J.E.H
DATE 6-3-23
FORM NO 18

TYPE & SIZE	COLUMN 1 IN USE AS OF 7-1-21 NUMBER	COST	COLUMN 2 INSTALLED FROM 7-1-21 TO 6-1-23 NUMBER	COST	COLUMN 3 REMOVED FROM 7-1-21 TO 6-1-23 NUMBER	COST OBTAINED FROM APPRAISAL AS OF 7-1-21 UNIT	TOTAL	COLUMN 4 = (1+2)-3 IN USE AS OF 6-1-23 NUMBER	COST
		$		$		$	$		$
¾" Bayliss	30	165.00	2	14.00	1	5.50	5.50	31	173.50
Grand Total - including Administration, Construction & Accounting Costs								31	173.50

FORM NO. 19

Name of Company

City or Town

SUMMARY OF PROPERTY
AS OF **June 1, 1923**

ACCOUNT NO	SUBJECT	TOTAL COST
1	GAS WORKS LAND	162,954.94
2	DISTRICT HOLDER LAND	9,900.13
3	DISTRIBUTION SYSTEM LAND	352.26
4	OTHER LAND	9,600.00
5	COAL GAS STRUCTURES	14,796.69
6	WATER GAS "	8,922.37
7	BOILER PLANT "	2,056.10
8	GENERAL WORKS	106,398.00
9	STORE DEP'T "	86,724.32
10	BOILER PLANT	78,949.20
11	COAL GAS EQUIPMENT	73,121.65
12	WATER GAS "	27,866.76
13	ACCESSORY COAL GAS PRODUCTION EQUIPMENT	4,265.24
14	" WATER " " "	42,726.36
15	COAL GAS PURIFICATION EQUIPMENT	3,210.20
16	WATER " "	22,150.64
17	GENERAL OFFICE "	8,765.26
18	STABLE AND GARAGE "	3,241.60
19	OTHER "	14,296.54
20	HOLDERS	136,400.60
21	GAS MAINS	297,326.62
22	GAS SERVICES	72,012.30
23	GAS METERS	99,241.04
24	METER CONNECTIONS	31,116.20
25	HOUSE GOVERNORS & CONNECTIONS	173.50
	TOTAL	1,316,568.52

SUBMITTED BY FIXED CAPITAL RECORDS DIVISION

J. E. Hay.
CHIEF **Engineer.**

Fig. 25

Ewald Haase (Milwaukee, Wis.): This committee has expanded their topic from the continuous inventory to capital records. That is fine, but my remarks will be confined to the question of inventory.

I have studied the various forms given by Mr. LaWall, Mr. Nelson, Mr. Conrad and Mr. Heyser, and my experience leads me to desire one other form that is not discussed. The forms designated by Mr. Nelson as "Exhibit E" and by Mr. Conrad as "Exhibit D" are admirable for the purpose of setting up a record of the cost unit as it is constructed. I take it the form is constructed from the books of original entry and at the time that a project is completed it is designed to give a form on which an engineer would set up the items of the unit, extending prices and showing quantities and dimensions, and coming down to the total cost.

Such a form should have the proper references back to the sources from which the items are taken. Not any one form will fit the tabulation of all of our properties. These forms here are generally adapted to projects involving construction of apparatus and structure, but do not lend themselves to the record for the cost of distribution, maintaining service and matters of that sort; also for the recording of the general equipment, furniture, etc.

Now, after Mr. Conrad's form records the cost of the project, in years to come that unit may undergo a change, it may be added to. That will involve at that time an entirely new project and that project should then be continued on a similar sheet in this year. Some time in the future a portion or all of this unit may be retired and there we have pertaining to this unit the original addition and retirement at some future time.

It does seem to be desirable to have, also, an inventory card, on which the original project is entered merely by reference to the name and other identifications that it may need; the record to also receive later any additions made to it, and either partial or whole retirement, so that the inventory shall be one recorded index to all the operations that pertain to any one unit. This inventory blank will be a blank for each unit of property, so that if you have a half dozen water-gas machines, you have one-half dozen cards or blanks, one for each of the water-gas machines. On the first line is the original entry. If, in later years, you add to that unit the automatic control, that would appear on the next line. If, at some future time, you retired machines or made certain alterations, that would appear on the next line. But the final result on that inventory blank would represent the status of the unit at any given time.

The inventory blank can be made in one form that will take in all of our various kinds of properties—distribution property and general equipment as well. From this inventory blank, it would be very easy to draw your final summary of fixed capital and we very often need just that final summary. We may at times need the details of each classification. We may need the construction detail in regard to the original cost. If we have in the final summary, the inventory blank, the inventory blank is an index to the original cost sheets or analysis sheets and that again refers back to the books of original entry.

That is what our experience leads us to believe would be the thing that we

lack, an avenue through which all the property is finally drawn down to the final summary.

A. S. Corson (Philadelphia, Pa.): While we might have our inventory as far as physical assets go, the main problem is to arrive at a certain fixed value. Once have the thing going, it seems a simple proposition to keep it working.

Very often on a company's books there is a certain one-figure value for all of the property. In order to take care of our retirements, etc., in later years, we have to have a starting point. How are we going to do that unless we make the inventory equal in value with our book figure?

W. A. Doering (Boston, Mass.): The great difficulty is the wide discrepancy between a physical inventory as given by the engineer for appraisal purposes and the actual book values. Unfortunately, in years gone by, if in any one year the company made a big profit, instead of creating a depreciation reserve, it credited plant and charged profit and loss, and the book value today has no relationship to its actual value.

While this paper is adaptable to companies that have built their plants within the last ten or fifteen years it is very difficult for a company that has been operating for say, one hundred or fifty years, to get a starting point.

William Schmidt, Jr. (Baltimore, Md.): This report contains some very good material, but we have got to be careful that we do not do too much accounting. I think we ought to resort to short-cuts wherever we can.

Take the method for the distribution of some of the indirect costs. In Baltimore we have a storeroom expense account, to which are charged all the storeroom expenses. We also charge to that account all freight, expressage, drayage, and credit it with all cash discounts. Each month we add to the completed job a percentage to cover the several items which I have just mentioned.

Speaking about inventory, in a recent decision handed down by the Maryland Commission in connection with a rate case of ours, the commission found the value of our property to be at least the par value of the stocks and bonds in the hands of the public, plus a surplus and reserve. Upon comparing their appraisal with our book figures, we found the difference to be only about ninety-nine thousand dollars. The total appraisal was something like eighty-six million dollars. We immediately petitioned the commission to permit us to take the inventory and set it upon our books, following the classification of accounts prescribed by the National Association.

Upon receipt of the petition by the commission they asked what the difference was between our fixed capital accounts and the appraisal. We told them about ninety-nine thousand dollars and they raised their appraisal ninety-nine thousand dollars so we are now starting out by distributing the appraisal according to the physical items of property. We have land, buildings, etc. The company is the oldest gas company in America, being incorporated in 1860, but we are going to start out with fresh items and we propose to keep them up to date.

Burton Smart (Portland, Maine): Mr. Schmidt spoke about crediting discounts to his storeroom account. Will he explain that just a little more fully?

William Schmidt (Baltimore, Md.): We have an account in the general ledger known as storeroom expense. It includes any other expenditures incurred in the handling of our storeroom, and we also charge to the same account, all freight, expressage, drayage, and all discounts taken for prompt payment of bills are credited to that account. Then at the end of each month, as the job orders are closed, we add a percentage to the job order account, and in connection with the operating value, we credit the total charges to various operating accounts and add a percentage at the end of the month. We save thousands and thousands of transactions in that way.

William Wurth (Chicago, Ill.): It is desirable to emphasize that a fixed capital record system is not such mainly for showing in dollars what your system is worth, but above all, a complete inventory of your equipment of plant and all the auxiliaries that go with it. If a company is fortunate enough to have a valuation or an appraisal to start with, all the better. If not, it would be certainly advisable to obtain the inventory of the system and then you will find it will be very easy to build on top of that system.

Most companies, (probably not knowing it) have a very substantial start in the direction of fixed capital records. In looking around in my own company, I find that different departments are performing tasks in that direction and they could be linked together, with very little additional work, to form a complete system of fixed capital records.

While these independent records very thoroughly serve the department in which they are done, they would have much more value if coordinated through a specific department to form a complete system.

F. H. Patterson (Rochester, N. Y.): We made a reappraisal of our property in 1918, and set the component parts of the cost upon the books subject to the sanction and review of the Public Service Commission in case of a rate case. We also opened cards for the various units and are carrying along a perpetual inventory.

In what department should the engineer or inventory man be placed? In our case he is under the Auditing Department, in the room adjacent to the Work and Progress Department, which is our Construction Department, so that he utilizes the original record without any interdepartmental records being necessary between two departments. I think it is done with a minimum of expense. In regard to the larger units, it is a comparatively simple thing—a separate card for a separate water gas set.

On gas main construction, we have a card for each size of main, the total quantity of feet installed and the total cost, and as additions or withdrawals are made, they are added or subtracted, and the grand total average cost per foot is the figure we write off during the succeeding year.

I think that is one of the problems Mr. Haase will have to contend with when he comes to it, but it could be done with a cumulative average figure.

One other point is the control of construction expenditures. Some companies simply make an analysis by jobs, with the original charges going right into the fixed capital accounts. Others, like ourselves, employ a work-in-progress system. This is nothing but a large suspense account and original additions

lie in there until the job is completed. Then the total cost is transferred periodically to the fixed capital account. It lends itself particularly well to withdrawals where we have to write out in a fixed capital account the original cost of the property and charge in the work in progress, then credit the salvage adjustment and charge in the expense of dismounting and the net difference which remains is written off against replacement reserve.

Furthermore, in this work-in-progress account you will frequently have jobs which entail charges to expense and charges to construction—and if it lies there in suspense until that cost is determined and appraised by the engineers, if necessary, the component parts of it can be charged to their respective accounts.

W. A. Doering (Boston, Mass.): Mr. Schmidt, when you wrote up your book value to the appraisal value, did you inflate your surplus account with the ninety-nine thousand dollars?

William Schmidt, Jr. (Baltimore, Md.): We did.

Ewald Haase (Milwaukee, Wis.): Since we have adopted the Uniform Classification of Accounts, we are particularly in need of fixed capital records inventories, because there is, as Mr. Patterson just stated, the mode of retirement prescribed.

Therefore, if the situation is not ripe for a complete inventory, it seems, nevertheless, desirable that every company should begin with the project that is at present in hand and build up a scheme for an inventory, because occasions may arise, as in the case of Baltimore. They might have started that system several years ago.

Edw. Porter (Philadelphia, Pa.): In the discussion of indirect or undistributed items of cost, mention is made of the tendency of many companies to charge too small a proportion of the time of the employees devoted to both operating and construction, to capital accounts. Usually a gas company requires a fixed operating personnel of a supervisory character. Their time should be charged to operating, otherwise expenses would fluctuate from year to year in the same proportion that capital charges fluctuate. Of course, the time of employees whose duties relate primarily to construction, such as main foreman, should be charged to construction. Employees whose duties are with the operating force and only incidentally are connected with construction should be charged to operating. That is sound accounting.

Any capital expenditures should justify themselves by increasing the income of a company. The mere allocation of operating salaries to a construction account will not increase the earning power of the new unit.

It is also well to bear in mind that any amount allowed as an operating expense in a rate case is more beneficial to a company if the same amount is allowed as a capital charge.

For example, a thousand dollars capitalized at eight per cent is equivalent to $12,500 as capital, whereas one thousand dollars as capital at eight per cent is only equal to eighty dollars when calculating the amount required to fix a rate. It will be seen from this that it is to the advantage of the company to take care of as many items as possible.

We should also consider that any capital charges which could be legitimately charged to operating tend to in-

crease your income taxes in some states. If, during the year, one thousand dollars of operating salaries were charged to construction, the income taxes would be increased approximately one hundred and twenty-five dollars and if the state income tax is in effect, these taxes would also have to be paid.

C. A. Schlegel (Philadelphia, Pa.): What Mr. Porter brought out was considered very carefully by the committee as we realized that someone would undoubtedly have that same point in view as to the expediency of allocating a charge either to operating or construction, in accordance, you might say, with the age-old practice of doing a thing.

We have tried to bring out the way in which any capital additions would be done by an outside contracting force, which of necessity must have all of its cost accounted for. A company which does its own construction work has certain facilities primarily used for operations which it uses for construction purposes and the result is that no proportion of the cost of their use is charged into the capital accounts.

Certainly we can not have our cake and eat it too. We can not charge operating with a proportion of what is truly capital addition, and then later on, in an inventory and appraisal in a rate case, under the heading of "Overhead" or "Indirect Items of Cost" have a flat percentage and get the same cost in also. We cannot get them into both places.

I believe there is a limit to which this allocation can be done, and I think in the case of St. Paul, they have, in addition to the store room expense item which all companies have, an item for superintendence and engineering, which they have based as a percentage factor from experience over a certain number of years, we will say.

Referring to the point that Mr. Haase raised regarding the original inventory, we avoided mentioning the starting point, since it differs in practically every case. In other words, one starting point is an absolute inventory and appraisal approved by the commission and set up on the books as a figure of the inventory and appraisal, and in another case it is the value of the bonds and stocks, as in the case of the Baltimore company. So all of our work has been along the line of doing now and in the future things in such a way that we would have the information that we would like to have.

In conclusion, I would like to recommend for the consideration of the next year's committee, that point of Mr. Porter's as to how far the allocation, of what are apparently operating expenses to capital account, should be gone into, because it was a question that was discussed by the committee.

A. C. Klein (Boston, Mass.): Mr. Porter said that he felt it would be better to charge most of these overhead items to operating expense, citing as one of the reasons that otherwise there would be a great fluctuation in the expenses from year to year. I imagine that is slightly over-estimated, because in a growing company most of the capital expenditures are for distribution extensions, and I think that they are practically uniform from year to year. Possibly in one year a large plant extension might be made which would have the effect of slightly reducing the operating expenses, but not materially.

Coming down to the economic phase of it which appealed to the committee, we have felt, and the point has been

brought out here in various discussions, that the whole purpose and trend of cost accounting, of keeping accounts and of rate hearings, is that the consumers should pay their just proportion of expenses incurred to give them service.

If you charge into the operating expenses the time and salaries of employees who are partly engaged in construction, you charge present-day consumers with expenses which should be spread through the medium of capital accounts to future consumers. Whatever the practice may be that is expedient at the moment, I believe you will ultimately have to come to the conclusion which is based, it seems to me, on sound economics, that today's consumers must not pay for expenses which are incurred for future consumers.

The Chairman: It is our good fortune to have Mr. Klumpp with us at this time, and I am going to ask him to speak, not alone as President-elect of the American Gas Association, but as a valuation engineer. Perhaps no other man in the country has had greater experience along that line than Mr. Klumpp.

J. B. Klumpp (Philadelphia, Pa.): I think I will have to confine my remarks to ones of greeting and to compliment you on the work that has been done by this section in the past year. The result of your discussions here and what I have heard from the members is that one has to go to the Accounting Section to hear real discussion.

I have been interested in accounting ever since my father made me take a bookkeeping course and two years' course in college work before he let me study engineering. If I started to talk on a subject of valuation, rate returns or capital accounts, I am afraid I would be talking here all the afternoon and to an empty house. There is no work that interests me more than that and I think that the Accounting Section of this Association is up to the top of all the utility associations in that line. I have heard expressions from the Street Railway men who stayed over for this convention, and also from the National Electric Light men who have attended this section.

I believe that you have only begun and I trust that the coming year will find you keeping up the good work and that you will give to our Association records and data as the result of your deliberations, which I believe are wonderful and are going to be of great value to the industry.

The Chairman: Our next report is that on Customers' Accounting.

REPORT OF THE CUSTOMERS' ACCOUNTING COMMITTEE

W. A. Doering, *Chairman,* Boston, Mass.

Introduction

Your Committee on Customer's Accounting was organized as outlined at the first meeting of the Managing Committee, to take last year's work as a basis and attempt to present to the industry definite recommendations as to possible economies by,

(a) Taking typical companies in various parts of the country and reducing their results to a comparable cost basis. All costs to be considered confidential and published under a key. The Committee's report to contain an analysis of these figures and a discussion of any special conditions affecting them.

(b) To keep in touch with the development of the so-called Baltimore System of Bookkeeping without Books through its adoption by other companies, notably the Public Service Company of Northern Illinois, etc. As this system includes the most progressive innovations designed for economies its successful use by other companies will be one means of keeping such economies before the industry.

(c) To go further into the subject of merchandise accounting.

For the purpose of carrying on these three activities the following sub-committees were appointed:

Sub-Committee on Costs
Sub-Committee on System of Bookkeeping without Books
Sub-Committee on Merchandise Accounting

These Committees have met and have prepared their reports which are appended herewith.

An additional activity was assigned to this Committee under the chairmanship of Mr. Paul D. Warren, to be known as the Sub-Committee on Exhibit. This Sub-Committee has prepared and has charge of the Accounting Section exhibition at the Convention. A great deal of credit is to be given to Mr. Warren for the good work which he has accomplished.

Sub-Committee on Costs

This Committee was very ably handled by Mr. W. G. Murfit without assistance and a great deal of credit should be given him for the very able and voluminous report which he has submitted. This report undoubtedly will be of great assistance to the industry as a whole.

Sub-Committee on System of Bookkeeping without Books

In view of the fact that this system represents the most economical method proposed to date of handling customers' accounts, and that its general adoption has only been prevented by considerations of its adaptability to all local conditions, etc., it was decided that the function of this sub-committee would be to keep in close touch with those companies that have adopted this system and to pre-

sent the following information relating to their individual experiences with it:

(a) Actual savings affected as compared with system formerly in use.
(b) Difficulties, if any, experienced in its introduction or operation.
(c) Any modifications introduced in the original system as it is applied in Baltimore because of such difficulties or to take care of special local conditions.

This Committee under the chairmanship of Mr. W. H. Cassell has presented herewith a very able report from the very meagre information obtainable on the progress made by the Public Utility Companies along the lines of Bookkeeping without Books. As it is pointed out in their report, no attempt was made to secure the actual savings affected by the installation of this system. As stated by the chairman of this committee in his report, some method of keeping the Accounting Section apprized of the various companies adopting this method of bookkeeping should be devised. The Customers' Accounting Committee certainly recommend that the Managing Committee of next year keep this in mind.

Sub-Committee on Merchandise Accounting

This Committee under the chairmanship of Mr. Keller has also done a very excellent piece of work and has presented descriptions of Merchandise Accounting Systems of various companies. While they are not presenting these systems as typical or ideal systems, they are, nevertheless, the very latest obtainable.

During the year your Committee has been of assistance to various companies, answering inquiries in reference to the report of the previous year.

A complete description of a Machine Bookkeeping System was sent to your Committee from the Portland, Oregon, Company. This description was published in the A. G. A. Monthly, and is also included as an appendix to this report.

In conclusion, while it was suggested that this Committee should finish up its work in the present year, the Committee does not feel that it would be wise to discontinue the work entirely, but recommends to the Managing Committee that a Customers' Accounting Committee be appointed in the coming year to keep in touch with, and advise the Managing Committee, as to the adoption by the various utilities of the system of Bookkeeping without Books; also as to the progress made in new installations of Merchandise Accounting. As the Merchandise Accounting will undoubtedly be one of our biggest problems, we consider it wise to keep in touch with its latest development, especially, as to accounting of the partial payment accounts.

REPORT OF SUB-COMMITTEE ON COSTS

W. G. Murfit, *Chairman, Newtown, Pa.*

There is no doubt in my mind that the originator of the questionnaires upon which this report is based was very unpopular when the aforementioned questionnaires were received by the members. I know that my own desk had a cubic foot, more or less, of questionnaires received during the year from various official and would-be-official sources. They looked like a census report without the sense.

On the other hand, seventy-three of the questionnaires sent out by our Committee were returned filled in, and when the time came to divide the dollars and cents by the number of meters, the burden was on my end of the line. However, I believe the effort was very worth while and that, at least for some of us, a great deal of good can be obtained by carefully studying these figures.

It must be realized that companies of different ages, some performing broader functions than others, located in various states with various Commission controls, some with uniform system of accounting, some without any supervision of accounting, can not answer these questionnaires and have the inclusiveness and exclusiveness of individual accounts exactly coincide. Your committee realized this in issuing the questionnaire, but believed that the classification as set forth in the National Uniform System would be best suited to solve the problem. A noble effort is being made by a proper committee of this association, co-operating with similar committees of State Gas Associations, to persuade respective State Commissions to adopt the National System or an accounting system as similar as possible. When this is done, and when the companies have had a year's time in which to follow such classification, compilation of a report such as this will be more practical.

For these reasons and believing that enough answers would be obtained from questionnaires without burdening the entire industry with them, only members of the Accounting Section Committee, and the companies in which those members were interested, were asked to submit answers. Those companies that have not seen the questionnaires will find a sample on page 5, and they can gather together their figures to fit the questionnaire, place them on a meter basis and compare with the results shown in this report. Thus, they can gauge the efficiency of their customers' accounting work.

To such as these, as well as to those companies who have submitted questionnaires, your committee provides a method for investigating the ways and means of bettering their systems. If, in comparing your results with any other company in this report, you wish to make inquiry about that other company, you can do so. Write to Mr. H. W. Hartman, Secretary of the Accounting Section at Association Headquarters telling him you would like

to get in touch with Company No. 28, for instance, in order to learn why their costs are lower than yours. Headquarters will at once write to Company No. 28 for permission to advise you of their identity and subsequent correspondence can be carried on direct. Those companies who have submitted questionnaires have been notified of their key number. One point that can not fail to impress you as a result of this report is that the accounting man has as extensive a field in which to cut costs as the distribution or production engineer. Companies of equal size showing a final variation of two or three dollars per meter in keeping the customers' accounting records, indicate that in spots there must be room for radical improvement.

Your Committee realizes that in making comparisons between companies, the most accurate one can not be obtained unless the grand total on the report is taken. This is because a number of companies were not able to segregate their merchandise costs, that frequently the supplies and expenses were included with the labor and that, indeed, the labor costs themselves were not as finely divided as would enable the company to answer the questionnaire in detail. On the other hand, there are a gratifying number that can be compared in detail, but it is the former set that causes the apparent vacant spaces on the report, particularly under question No. 761-4 and No. 614.

It is interesting to note the extent to which the accounting on prepay meters exceeds that of regular meters, and that also electric meter accounting is usually more costly. The variation in costs emphasizes the necessity of a fair examination of each company's accounting system. Every officer in charge of accounting should inquire, first: Is my system of accounting comparable with that of other companies reporting the same number of meters, either in detail or in summary?; second: What am I doing that could be better performed another way or eliminated altogether? Are wages in my district comparable to those in other districts? What is it that makes my costs seem higher?

The tabulated data for each company is arranged in such fashion that there was not room to relate fully therein some of the detailed explanations submitted, consequently it was found necessary to add notations, commencing on page 7 regarding each of the companies. Therefore, after comparing the tabulated data, please refer back to the respective company's notes where further details are given.

The questionnaire and the letter that accompanied it, originally issued on February 19th, 1923, follows:—

To Members of the Accounting Section, American Gas Association.

February 19, 1923.

Dear Sirs:

As you know, the Accounting Section of the A. G. A. desires this year, among its other activities, to obtain from companies data showing comparable costs of customers' accounting. It is probable that some of us are functioning along these lines at too high a cost. We aim, by this sub-committee, to learn how the lowest costs can be attained without sacrificing service, and so submit this questionnaire only to the members of the Accounting Section, and of its various committees.

Each year it seems that the membership as a whole is burdened with an increasing number of questionnaires from various "powers that be." Accordingly, the Accounting Section has decided to limit the circulation of this questionnaire to the members of that section. You will realize, therefore, that to obtain worthwhile data, each questionnaire issued should be answered. You, as an accounting man, are tremendously interested in

this subject under analysis, you want to reduce your costs all you possibly can and the combined answers to this questionnaire will help you do it. Consequently, I know we can depend upon you to return promptly one of the enclosed, properly filled out with data pertinent in your location.

You will note that the requested costs follow the classification in the Uniform System, but in one or two places the segregation is a little finer. On the other hand, a number of divisions are omitted as the purpose of the Committee is to confine the problem to the points covered.

I wish to assure you that these answers will be held confidential by me and that most of the information will be included with others of a similar nature in order to obtain an average. Of course, should your answer indicate particularly happy results in one or a number of phases, you will be begged to advise us, and the industry, how you obtained them.

Will you address any questions you may have to ask, and also the questionnaires, to

Very truly yours,
W. G. MURFIT, *Chairman,*
Sub-Committee on Costs.

W. G. MURFIT, *Secretary-Treasurer,*
Bucks County Public Service Company,
Newtown, Pennsylvania.

QUESTIONNAIRE

1. Name of Company ....
2. Address ....
3. Name of Officer or Employee submitting this report ....
4. Address ....
5. Average number of meters in use 1922.

	Gas(G)	Electric(E)	Total(T)
Regular (R)			
Prepay (P)	....	....	....
Total(T)			

6. Meter readers report at (how many) .... different offices;
7. Collectors report at (how many) .... " "
8. Books kept at (how many) .... " "

Note: No. 6, No. 7, No. 8, refer to number of offices the cost of which will be included in the data given below.

9. Are meters read, bills delivered, and collection effected by three sets of forces, in three operations, or by any combination of these? Please describe system very briefly ....
....
10. Have you adopted, partially or wholly, the system of Bookkeeping Without Books? If so, please describe to what extent ....
....
....
11. What mechanical devices do you use other than typewriters and adders? ....
....
....

12. Symbols herein used are:—

G.R. Gas regular meters	G.M. Total gas and merchandise
G.P. Gas prepay meters	Elec. Electric meters
T.G. Total gas meters	G.&E. Gas and Electric meter accounts
Mdse. Merchandise or jobbing	G.E.M. Gas and Electric meters and merchandise accounts.

13. Are merchandise sales entered on the gas bill? ....
14. Are merchandise sales collected at same time as gas bill? ....
15. What was the total of Merchandise SALES during the period covered by costs herewith given? $......................

Data to include all offices of the Company for the year, 1922, or last fiscal year in which event note here the period covered.

761.1 Commercial General Labor.

This account shall include the cost of labor of superintendents and assistants, chief clerks, cashiers and assistants, stenographers, general clerks, high bill clerks, switchboard operators, messengers, janitors and watchmen employed in the Commercial Department.

G.R.$.......... G.P.$.......... T.G.$.......... Mdse.$.........
G.M.$.......... Elec.$.......... G.&E.$........ G.E.M.$........

761.21 Commercial Bookkeeping Labor.

This account shall include the cost of labor of bookkeepers and clerks employed on customers' accounts.

G.R.$.......... G.P.$.......... T.G.$.......... Elec.$..........

761.22 Commercial Contract Labor.

This account shall include the cost of labor of clerks and others employed in the application of contract bureau.

G.R.$.......... G.P.$.......... T.G.$.......... Elec.$..........

761.31A Commercial Collecting Labor.

This account shall include the cost of labor of collectors. The prepay data will include a proportion of such meter readers' time engaged in reading prepay meters.

G.R.$.......... G.P.$.......... T.G.$.......... Elec.$..........

761.31B Commercial Bill Delivery Labor.

This account shall include the cost of labor of bill deliveries.

G.R.$.......... Elec.$.......... G.&.E.$..........

761.32A Meter Reading Labor.

This account shall include the cost of all the labor of the regular meter readers, and the balance (see 761.31A) of the time of the prepay meter readers.

G.R.$.......... G.P.$.......... T.G.$.......... Elec.$..........

761.4 Commercial Supplies & Expense.

This account shall include the cost of supplies, transportation, and incidental expenses of the Commercial Office. Items such as consumers' ledgers, uniforms, equipment, etc., charged to operating should be included only to the extent of one year's amortization thereof.

	(A) Office Items	(B) Meter Reading Items	(C) Bill Delivery Items	(D) Collecting Items	(E) Total
G.R.	$...........	$...........	$...........	$...........	$...........
G.P.	$...........	$...........	$...........	$...........	$...........
T.G.	$...........	$...........	$...........	$...........	$...........
Mdse.	$...........	$...........	$...........	$...........	$...........
G.M.	$...........	$...........	$...........	$...........	$...........
Elec.	$...........	$...........	$...........	$...........	$...........
G.&E.	$...........	$...........	$...........	$...........	$...........
G.E.M.	$...........	$...........	$...........	$...........	$...........

614 Merchandise and Jobbing (Accounting Department)

This account shall include items indicated below that are chargeable only to work of this kind.

	(X) Labor	(Y) Supplies & Exp.	(Z) Total
A. Order writing. (Items incurred before job is done).	$...........	$...........	$...........
B. Billing, Ledger entering, etc. (Incurred after work is done and to and including issuance of bill.	$...........	$...........	$...........
C. Collecting.	$...........	$...........	$...........

Remarks:—

The detailed notes on each company's operation are as follows:

NOTES ON COMPANIES

General. Questions 9 and 11 (see questionnaire page 5) obviously could not have been included with the tabulated data, hence are answered below. Detailed explanation of other questions in the questionnaire.

No. 1. Co.—

Q. 9—

Continuous meter reading (Men)
Continuous bill delivery (Boys)
Continuous collecting (Men)

Q. 11—

Burrough's Billing, Burrough's Registering, Elliott-Fisher, Bill Folding Machine, Envelope Opening Machine, Envelope Sealing Machine, Brandt Automatic Cashiers and Pitney-Bowes Postage Meter Co. Machine.

No. 2 Co.—

Q. 9—

Meters are read by readers and bills are delivered by collectors.

Q. 11—

Burrough's Billing Machine making a complete gas bill except address which is done on Automatic Addressograph.

Q. 761.31B—

Included in Collection Dept.

Q. 614 C—

Included in gas collecting. Both collected simultaneously.

No. 3 Co.—

Q. 9—

One force reads meters. The second force distributes and collects the bills. If bills are not paid to collectors they are paid at office.

Q. 11—

Burrough's Billing Machine puts indexes on bills. Todd Protectograph Machine put gross discount and net on bills and coupons. We use Munroe calculators.

Q. 761.31B—

Included in Collection Dept.

Q. 614A—

Included under section of B of same question.

No. 4 Co.—

Q. 9—

Meters read and bills delivered by one set of men. 98¾% of bills paid at office, 7 men collect delinquent bills and weekly accounts. Shut off for non-payment is charged this account.

Q. 11—

Addressograph, Burrough's Billing Machines.

Q. 13—

Regular bills are billed separately but are added to gas bill if not paid in 60 days. Lease Sales are added to gas bill monthly.

Q. 614—

Included in Commercial Office Expense.

No. 5 Co.—

Q. 9—

Meters are read, bills delivered and collections effected, by three separate forces.

Our city is divided into 24 districts and the above forces work approximately one district per day.

Meters are read on a "piece work" basis.

Bills are delivered by youths ($10.00 to $13.00 per week). The first and second notices for current overdue accounts are sent by mail. The collection force working the "cut off" orders only. Each collector works approximately 7 days each month on current work, the rest of his time being devoted to final bill collections.

Q. 11—

Addressograph Equipment, Rubber Stamp for bill extension, Burrough's Billing Machine and special 17 bank adding machines.

Q. 614—

The items in the "A" and "C" subdivisions of this question are carried on by the same staff which handle the gas accounts, consequently, it is impossible to give separate figures. For the "B" division see Mdse. under 761.21.

No. 6 Co.—

Q. 9—

Meters read by meter readers. Bills are delivered by mail, collections on delinquent accounts are made by collectors.

Q. 11—

Addressograph for addressing bills. Burrough's machines for debit posting, billing and cash posting.

Q. 761.31B—

Postage and stationery, mailing bills.

No. 7 Co.—

Q. 9—

The company reads its meters commencing on the 16th day of the month of 31 day-months and on the 15th day of the month of 30 days except when the 15th or 16th day of the month falls on a Sunday or holiday, we commence reading on the day thereafter and read continuously over the balance of the month. The same force who reads the meters, deliver the bills the 1st five days of the following month. After the tellers balance their collections for the 12th, they get their reading routes in shape to commence reading the meters again on the 15th or 16th as the case may be.

Q. 11—

We are now installing billing and posting machines.

Q. 13—
We do no merchandising. Miscellaneous and jobbing accounts are entered on Gas and Electric Bills.

No. 8 Co.—

Q. 9—
Meters are read and Brockton bills are delivered by meter readers. Bills outside Brockton are mailed. Collections are made by separate force.

Q. 11—
Burrough's Bookkeeping Machines, change makers, cash registers, addressograph machines, graphotype machines, line-a-time copy holders, automatic envelope sealers, 4 models debiting billing, credit posting and master control.

No. 9 Co.—

Q. 9—
Meters are read by one set (meter readers), skipped reading and bills are delivered by another group of men in same division (bill deliverers). Delinquent customers are handled by another division. Bills paid at main office and 60 pay stations.

Q. 11—
Multigraph, addressograph, graphotype, multipost, and envelope sealer.

No. 10 Co.—

Q. 9—
Meters are read and bills are delivered by same force. Collections are handled separately.

Q. 11—
Remington Make for Billing and Burrough's Duplex for entering in Ledgers and abstracting sales.

Q. 15—
No merchandise sold by this company.

No. 11 Co.—

Q. 9—
Meters read and bills delivered by meter readers; collection by collectors.

Q. 11—
One Remington-Wahl Machine and one Burrough's Posting and Abstracting Machine.

Q. 13—
Not doing a Mdse. business, handled by another company.

No. 12 Co.—

Q. 9—
Meter readers read for period of 10 days then deliver bills for one day. Separate force of collectors.

Q. 11—
None used.

Q. 614—
No separate acount is kept. Included in question number 761.4.

No. 13 Co.—

Q. 9—
Meters are read by men who do nothing else but read meters. Bills are delivered and collected by men which we term as Bill Deliverers, who do nothing else but collect and deliver, however, less than 2% of bills are collected.

Q. 11—
Burrough's billing or subtracting machines used for computing consumption of cubic feet and k.w.h. on bills. Todd Billers are used to extend both G. &. E. amounts on bills. Underwood Bookkeeping machines are used for sales sheet. Hollerith Tabulating machines are used for different classification, computing revenue, proving bills, etc. Elliott-Fisher machines used in Appliance Bookkeeping Dept.

Q. 10—
Partially. Inasmuch as all entries from G. & E. are made on a sales sheet with 50 entries on a side. The following entries are made: Name and address, present reading current amt. gas, current amt. elec., penalty gas, penalty elec.

Q. 614—
Stationery and printing supplies relating to question 614 are included in 761.4.

No. 14 Co.—

Q. 9—
Meters read by meter readers. Bills delivered by meter readers and collectors.

Q. 11—
Addressograph, Graphotype, Cumnings receipting machine, Brandt Automatic Changers, Envelope sealing machine and Postage stamping machine.

Q. 13—
Merchandise accounting handled by a separate corporation.

Q. 761.21—
Included in 761.1.

Q. 761.22—
Included in 761.1.

Q. 761.31B—
Included in 761.31.

No. 15 Co.—

Q. 9—
Meters read and bills delivered by same force. Collections by another force.

Q. 11—
Burrough's Bookkeeping Machines, Addressograph, Rate calculating charts, Cumnings receipting machines, Brandt Automatic Changers.

Q. 15—
Merchandise sales handled by separate corporation.

Q. 761.21—
Included in 761.1.

Q. 761.22—
Included in 761.1.

Q. 761.31B—
Included in 761.31A.

No. 16 Co.—

Q. 9—
Meters read and bills delivered by same force. Collection effected by separate force.

Q. 11—
Cumnings Receipting machines, Brandt Automatic changers.

Q. 761.21—
Included in 761.1.

Q. 761.22—
Included in 761.1.

Q. 761.31B—
Included in 761.31A.

Q. 15—
Merchandise sales handled by another corporation.

No. 17 Co.—

Q. 9—
Meters read and bills delivered by same force. Collections by another force.

Q. 11—
Cumnings receipting machines. Brandt automatic changers.

Q. 15—
Merchandise sales handled by separate corporation.

Q. 761.21—
Included in 761.1.

Q. 761.22—
Included in 761.1.

Q. 761.31B—
Included in 761.31A.

No. 18 Co.—

Q. 9—
Meters read and bills delivered by same force. Collection effected by separate force.

Q. 11—
Cumnings receipting machines. Brandt automatic changers.

Q. 15—
Merchandise sales handled by a separate corporation.

Q. 761.21—
Included in 761.1.

Q. 761.22—
Included in 761.1.

Q. 761.31B—
Included in 761.31A.

No. 19 Co.—

Q. 9—
Meters read by one force. Bills delivered by mail. Collection effected by separate force.

Q. 11—
Addressograph, Cumnings receipting machines. Brandt automatic changers.

Q. 15—
Merchandise sales handled by a separate corporation.

Q. 761.21—
Included in 761.1.

Q. 761.22—
Included in 761.1.

Q. 761.31B—
Included in 761.31A.

No. 20 Co.—

Q. 9—
Readers read only. P. P. readers read and remove coins only. Bill deliverers accept payment of current accounts and request payment on bills where arrears appear. Collectors call for all accounts open after discount date.

Q. 11—
Graphotype, Addressograph, Remington Accounting Machine with Wahl adders attached.

No. 21 Co.—

Q. 9—
Meter readers read and deliver bills. Bills payable at office, delinquent notified by mail notice and if necessary followed up by shut off notice, dead accounts by personal call of collector.

Q. 11—
Addressograph with Graphotype in connection, Brunsviga Calculating machine.

No. 22 Co.—

Q. 9—
Three-part system—6 meter readers—one bill delivery man—four men regular collection force. Three men for final bills.

Q. 11—
None used.

Q. 614—
A—order writing performed by sales clerk, New Bus. Dept. B—included in Item Mdse. 761.1. C—included in Item Mdse. 761.31A.

No. 23 Co.—

Q. 9—
Meters are read by one man. All bills sent by mail. Collections are made by one man who reads meters.

Q. 11—
Elliott Envelope Sealer, Multipost, Addressograph, Outlook Envelope, Brunsviga, Check Protector, Numbering Machine, Egry Register.

No. 24 Co.—

Q. 9—
Three sets. Meter readers—bill boy—collector.

Q. 11—
Addressograph, Munroe Calculator, Burrough's Adding Machine.

Q. 761.31A—
Included in 761.22.

No. 25 Co.—

Q. 9—
Meters read and bills delivered by same force. Collections made by separate force.

Q. 11—
None used.

No. 26 Co.—

Q. 9—
Three sets of forces. Meter books are handed to bill clerks and bookkeepers and bills mailed. Delinquent collected by letter and shut off notices. Delinquent merchandise bills by collector.

Q. 11—
Remington typewriter with Wahl attachments, Addressograph, Brandt automatic changers.

No. 27 Co.—

Q. 9—
Meters read by one group. Bills collected and delivered by one group.

Q. 10—
Now in process of change. About two-thirds changed over.

Q. 11—
Addressograph, Abbott Coin Counter, Brandt Automatic Cashier.

No. 28 Co.—

Q. 9—
Regular and Prepayment meters read by same force. Collections made by separate force. Bills mailed on post cards.

Q. 11—
Burrough's Billing Machine for gas bills. Addressograph Machines.

Q. 761.31B—
Bills mailed.

Q. 614A—
Not applicable to accounting department.

No. 29 Co.—

Q. 9—
Post card delivery by mail. Large number of accounts paid at offices. Collections not made on delivery of bill.

Q. 11—
Remington Accounting Machine for making gas bills.

No. 30 Co.—

Q. 9—
Three forces working from the Commercial office, under direction of the office manager.

Q. 11—
Remington Accounting Machine for making gas bills.

No. 31 Co.—

Q. 9—
Meters read and bills delivered by one force. Payments made at the office.

Q. 11—
Addressograph Model B.

Q. 13—
No current sales but delinquent are entered on gas bills.

No. 32 Co.—

Q. 9—
Four meter readers and three collectors are required. Bills are mailed on post cards.

Q. 10—
Installing this system at present time.

Q. 11—
Remington Wahl Billing Machine, addressograph machines and multigraph.

Q. 761.31B—
Cost of mailing.

No. 33 Co.—

Q. 9—
Continuous meter reading by one man. Bills afterward delivered by same man. Bills paid at office. Balance left after discount period called for by collectors.

Q. 11—
Check writer, addressograph and a calculating machine, numbering machine.

No. 34 Co.—

Q. 9—
Meter reading Dept. read meters. Bills mailed on post cards. Collection Dept. follows delinquent bills.

Q. 11—
None used.

Q. 761.31B—
Post cards used for bills.

No. 35 Co.—

Q. 9—
Meters read by one group continuous reading. Bills sent out on post cards. Collections made by second group.

Q. 11—
None used.

No. 36 Co.—

Q. 9—
Three sets, three operations.

Q. 11—
None used.

No. 37 Co.—

Q. 9—
Three sets, three operations.

Q. 11—
None used.

No. 38 Co.—

Q. 9—
Meters read and bills delivered by meter readers, payable at office by consumer.

Q. 10—
Have only used it during the month of January. Using extra coupons for office record.

Q. 11—
None used.

No. 39 Co.—

Q. 9—
Meters read by one meter reader and assistant, bills sent by mail, collections if necessary made by collector.

Q. 11—
None used.

No. 40 Co.—

Q. 9—
One man reads all meters and delivers all bills.

Q. 11—
Brunsviga Calculating Machine and G. W. Todd Protectograph.

No. 41 Co.—

Q. 9—
Meter readers deliver the major portion of gas bills, the balance are mailed. Collections are handled by separate force.

Q. 11—
Comptometer in General Office, Brunsviga Calculating Machine in Work Office.

No. 42 Co.—

Q. 9—
Meter readers read all meters and deliver bills 3 or 4 days after meters are read. Collectors collect bills only after discount has expired.

Q. 11—
Addressograph and Graphotype.

No. 43 Co.—

Q. 9—
Meter readers read regular and prepay meters at same time, covering route just once. Meter readers and collector deliver 2,000 bills. 4,000 bills are mailed. No collections made on delivery.

Q. 11—
None used.

Q. 13—
Itemized mdse. sales are mailed out immediately after job is completed. Total amount of charge shown on gas bill at end of each month.

Q. 614—
This is included in general commercial work in this office, as the order clerk makes up sales orders as well as answering telephone and taking orders at order desk. For that reason it seems impossible to give an estimate for items under 614.

No. 44 Co.—

Q. 9—
Yes, with the exception of about 4,000 meters, in which case meter readers read meters, make up bills and collect.

Q. 10—
Experimenting at present time.

Q. 11—
Bookkeeping Machine.

No. 45 Co.—

Q. 9—
Meters are read and bills delivered by the meter reading department. Current bills are paid at office, express company offices and other collection agencies. Delinquent bills are collected by our collection department.

Q. 11—
Addressograph and billing machines.

Q. 13—
Installment payments only.

Q. 14—
Installment payments only.

No. 46 Co.—

Q. 9—
Meter readers deliver bills, except those mailed out in thinly populated territory.

Q. 11—
Burrough's Subtracting machine and billing machines. National cash register and two receipting machines.

Q. 13—
We have no merchandise sales. Amounts for connecting stoves, run-

ning house and service piping, and elec. services are entered on gas and electric bills.

No. 47 Co.—

Q. 9—
Yes, separate meter readers and collectors—bills delivered by mail.

Q. 11—
Addressograph, Reuter Calculating Machine.

No. 48 Co.—

Q. 9—
Meters read and bills delivered by same force. Collections handled by separate force.

Q. 11—
Addressograph—Rubber Stamp for extension on bills.

Q. 761.1—
Commercial General Labor included $16,142.73 expense incurred by pay stations. These are drug stores throughout the city and they receive a fee of 1⅛c per collection. If the company did not have these agencies its cashiers would have to be enlarged.

No. 49 Co.—

Q. 9—
Meters read by two meter readers, 1 section per day. City divided in 22 sections. Bills delivered by boy, some mailed. Collector makes collections on daily routes billed each day. Three sets of forces in three operations.

Q. 11—
Two Munroe Calculators.

No. 50 Co.—

Q. 9—
Three sets of forces in three operations.

Q. 11—
Johnson Coin Counting Machine, Brandt Automatic Cashier, Check Protector.

No. 51 Co.—

Q. 9—
Meters are read by meter readers working under meter foreman. All bills mailed. Only bills on which shut-off notice has been sent are collected by collector.

Q. 11—
None used.

No. 52 Co.—

Q. 9—
Meters are read and bills delivered by individual forces. Collections are made under the supervision of Local Collection Manager.

Q. 11—
Addressograph.

No. 53 Co.—

Q. 9—
By three sets (Regular and prepayment meters read together).

Q. 11—
Burrough's subtracting machine for gas bills. Addressograph for printing bills.

No. 54 Co.—

Q. 9—
Regular gas and electric and prepay gas meters are read and cash removed from prepay gas meters by meter reading department. Bills are made out by billing clerks and given bookkeepers, after accounts are entered on ledger cards and balances entered on bills, bills without balances are delivered and those with balances have notices sent out and if not paid within a given number of days, the collection department call personally on the customers. If they call without results the notice is returned to the office and the order clerk issues for works to collect or remove meter.

Q. 11—
One Elliott-Fisher Billing Machine for order clerk.

No. 55 Co.—

Q. 9—
Reading and billing done separately. Collection by billing department.

Q. 11—
None used.

Q. 761.1—
None of these charged to Commercial Dept.

Q. 761.22—
Included in 761.21.

Q. 761.31A—
No regular collector.

Q. 761.31B—
No bills delivered.

Q. 614—
Included in 761.4.

No. 56 Co.—

Q. 9—
Meters are read by meter readers, bills delivered by bill deliverers, collections made by collectors and cashiers.

Q. 11—
Addressograph Machine, Brandt Coin Changer, Dictaphone.

Q. 761.1, 761.21, 761.22, 761.31A, 761.-31B.
"A great deal of detail work would be involved to sub-divide this company's accounts."
Summary data to fit the questionnaire under their plant was forwarded and applied by the author of this paper against the questionnaire in a manner he deemed best. Items 761.1, 761.21, 761.22, 761.31A, 761.31B, could not be segregated and so are included together on the summary sheet under 761.31B division. Likewise 761.4 is as finally and accurately divided by author as data submitted allowed.

Q. 614—
Records of company are not sub-divided in this way.

No. 57 Co.—

Q. 9—
Our meters are read, bills mailed out and collections effected in three operations.

Q. 11—
Munroe Calculator.
This company's accounts are not kept in such a manner as to permit questionnaire to be filled out accurately in detail. The assignment of the company's accounts summary against questionnaire made by author of the paper. Items number 761.1 and 761.31B could not be isolated so are included in other accounts.

Q. 614—
Records of company are not sub-divided in this way.

No. 58 Co.—

Q. 9—
Bills in business district delivered by messenger. Remainder, U. S. Mail.

Q. 11—
Addressograph. Bills are made on special machines made by Defiance Check Writer Co.

Q. 761.1—
Included in 761.21.

Q. 761.31A—
Included in 761.32A.

Q. 761.31B—
Included in 761.32A.

Q. 761.4—
Merchandise charges are not kept separately.

Q. 614—
Records of this company are not sub-divided in this way.

Q. 15—
Gas only.

No. 59 Co.—

Q. 9—
Meters read, bills mailed, and only delinquent customers called on by collectors. All under general supervision of ledger clerk.

Q. 11—
None used.

Q. 14—
Collected on partial payment plan.

Q. 761.31B—
Bills are mailed.

Q. 761.4—
Included with other charges.

No. 60 Co.—

Q. 9—
Meter readings passed to Bookkeeper who makes bills which are mailed out. Use collector only on delinquents.

Q. 11—
Munroe Calculating Machine and Addressograph.
Company's accounts are not kept along this line as listed in questionnaire. Company submitted its costs under its own account names and these were applied against questionnaire as accurately as author found possible. Apparently all costs are included and though details may not be quite comparable with other companies yet the totals should be.

Q. 761.1, 761.21, 761.22—
Are included in 761.31A.

Q. 761.31B.
Is included with 761.32A.

Q. 761.4, 614—
Included in either 761.31A or 761.-32A.

No. 61 Co.—

Q. 9—
Three separate operations. Meters are read during last nine working days, bills delivered on first two working days and collection made during ten days following delivery of bills each month.

Q. 11—
Rubber Stamps for calculating gas bills and Burrough's calculating machine for calculating electric bills.

Q. 614C—
Included with Commercial General Labor, separation cannot be made.

No. 62 Co.—

Q. 9—
Meters read and bills delivered by same force. Bills collected at office.

Q. 11—
Burrough's Duplex Adding Machines used for all posting on consumers' ledgers, names printed on bills with addressograph.

Q. 13—
No. Are attached to them.

No. 63 Co.—

Q. 9—
Meters read by men from fitting dept., from the 20th to 30th of each month. These same men deliver bills on last day of month. Reading and collecting on prepayment meters made by special man from 15th to 20th of month. Collection of arrears made by different and separate department.

Q. 11—
Brandt Cashier, Staats Change Machine, Thatcher Calculators, Elliott Addressing Machine.

Q. 13—
Statement of merchandise accounts attached to gas bill.

No. 64 Co.—

Q. 9—
Meters read by readers and they deliver about 50% of bills, balance mailed. Collections are a separate force.

Q. 11—
None at present. Have an order for a Burrough's billing machine.

Q. 761.1, 761.21, 761.22, 761.31A—
Included in 761.31B.
Company's accounts are not kept along same line as accounts listed in questionnaire. Company submitted its own costs under its own account names and these were applied against questionnaire as accurately as author found possible. Apparently, all costs are included and though details may not be quite comparable with other companies yet the totals should be.

Q. 614—
Included with other accounts.

No. 65 Co.—

Q. 9—
One set only, delivered first five working days; meters read in nine days beginning the 13th day from last working day; balance of month on collections.

Q. 11—
Offices use rubber stamps for printing amounts on bills; trying a machine that prints amount of bill on bill and both coupons at one impression, machine does work well but is not as fast as rubber stamp method.

Q. 614—Y column—
Included in 761.4.

No. 66 Co.—

Q. 9—
Combined. Name to the page ledgers entered in longhand, totals and statistics compiled by Hollerith.

Q. 11—
Hollerith Machine.

Q. 761.1, 761.22, 761.31B—
Company's accounts do not show gas and electric separately. Also, accounts do not quite coincide with those of questionnaire and adjustment had to be made.

Q. 614—
Records of company not sub-divided in this way.

No. 67 Co.—

Q. 9—
These three (3) departments report directly to head of accounting department and function independently of each other.

Q. 11—
Munroe Calculators.

Q. 761.1, 761.21, 761.22, 761.31A, 761.31B, 761.32A—
Company's accounts do not show any separation of regular from prepay and are not arranged like those in questionnaire. Accounts 761.1, 761.21, 761.22, are included in 761.31A. Account 761.31B is included with 761.32A.

Q. 614—
Included with other accounts.

No. 68 Co.—

Q. 9—
One force.

Q. 11—
None used.

Q. 7—
G. 2, E. 5.

Q. 761.31B—
Included in 761.32A.

Q. 761.4—
Column C in G.R., Elec., G.&E., G.E.M. are included in Column B.
Column D in G.R., Elec., G.&E., G.E.M. are included in Column B.

Q. 614—
Records of company are not subdivided in this way.

No. 69 Co.—

Q. 9—
These three (3) departments report to the head of their respective accounting departments and function independently of each other.

Q. 11—
Munroe Calculator.

Q. 761.1, 761.21, 761.22—
Included in 761.31A.

Q. 761.31B.
Included in 761.32A.

No. 70 Co.—

Q. 9—
Read by one force, delivered by U. S. Mail, collected at offices. Collection made by collectors only when other methods are impossible.

Q. 11—
Addressograph, Standard Envelope Sealer.

Q. 13—
In cases where merchandise is sold on monthly payment plan, the monthly installment is entered on gas bill.

Q. 761.1—
Included with 761.21.

Q. 761.31A—
Included in totals shown under 761.21.

Q. 761.31B—
Mail used exclusively.

No. 71 Co.—

Q. 9—
Meters read and bills delivered by one force in two operations; collections made partly by force delivering bills, partly by office collection department, partly by Express Co. agencies, also by outside collection.

Q. 11—
Barrett Change-making machines, Cumnings Perforating Machines,

Q. 614—Y column—
Included in 761.4.

No. 66 Co.—

Q. 9—
Combined. Name to the page ledgers entered in longhand, totals and statistics compiled by Hollerith.

Q. 11—
Hollerith Machine.

Q. 761.1, 761.22, 761.31B—
Company's accounts do not show gas and electric separately. Also, accounts do not quite coincide with those of questionnaire and adjustment had to be made.

Q. 614—
Records of company not sub-divided in this way.

No. 67 Co.—

Q. 9—
These three (3) departments report directly to head of accounting department and function independently of each other.

Q. 11—
Munroe Calculators.

Q. 761.1, 761.21, 761.22, 761.31A, 761.-31B, 761.32A—
Company's accounts do not show any separation of regular from prepay and are not arranged like those in questionnaire. Accounts 761.1, 761.21, 761.22, are included in 761.-31A. Account 761.31B is included with 761.32A.

Q. 614—
Included with other accounts.

No. 68 Co.—

Q. 9—
One force.

Q. 11—
None used.

Q. 7—
G. 2, E. 5.

Q. 761.31B—
Included in 761.32A.

Q. 761.4—
Column C in G.R., Elec., G.&E., G.E.M. are included in Column B.
Column D in G.R., Elec., G.&E., G.E.M. are included in Column B.

Q. 614—
Records of company are not sub-divided in this way.

No. 69 Co.—

Q. 9—
These three (3) departments report to the head of their respective accounting departments and function independently of each other.

Q. 11—
Munroe Calculator.

Q. 761.1, 761.21, 761.22—
Included in 761.31A.

Q. 761.31B.
Included in 761.32A.

No. 70 Co.—

Q. 9—
Read by one force, delivered by U. S. Mail, collected at offices. Collection made by collectors only when other methods are impossible.

Q. 11—
Addressograph, Standard Envelope Sealer.

Q. 13—
In cases where merchandise is sold on monthly payment plan, the monthly installment is entered on gas bill.

Q. 761.1—
Included with 761.21.

Q. 761.31A—
Included in totals shown under 761.21.

Q. 761.31B—
Mail used exclusively.

No. 71 Co.—

Q. 9—
Meters read and bills delivered by one force in two operations; collections made partly by force delivering bills, partly by office collection department, partly by Express Co. agencies, also by outside collection.

Q. 11—
Barrett Change-making machines, Cumnings Perforating Machines,

[1]See notes for answers to questions 9 and 11; No. 12 is merely explanatory. See questionnaire.

COST DATA ON CUSTOMERS' ACCOUNTING

Companies' Reference Code Numbers

Line No.	Questionnaire No.	ITEMS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	5	Average Number Meters in Use, 1922																						
2		Gas, Regular (G. R.)	713,875	186,151	36,800	69,268	129,171	13,500	12,836	21,721	67,496		12,484	12,475	80,292	11,529	11,781	8,045	5,013	10,992	13,118	18,343	5,860	8,252
3		Gas, Prepay (G. P.)		49,265	50	——	——	——	8	135	10,972											8,232	173	529
4		Gas, Total (T. G.)	713,875	235,416	36,850	69,268	129,171	13,500	12,844	21,856	78,468	18,622	12,484	12,475	80,292	11,529	11,781	8,045	5,013	10,992	13,118	26,575	6,033	8,781
5		Electric (Elec.)							12,062			20,091	10,158	7,113	42,752	12,453	14,127	6,749	6,168	15,275	19,896			10,036
6		Grand Total Meters in Use	713,875	235,416	36,850	69,268	129,171	13,500	24,906	21,856	78,468	38,713	22,642	19,588	123,044	23,982	25,908	14,794	11,181	26,267	33,014	26,575	6,033	18,817
7	6	Meter Readers report at how many offices?	1	3	1	1	1	1	1	1	1	1	2	1	1	3	3	3	2	2	4	4	1	1
8	7	Collectors report at how many offices?	1	3	1	1	1	1	1	1	1	1	2	1	1	3	3	3	2	2	4	4	1	1
9	8	Books are kept at how many offices?	1	3	1	1	1	1	1	1	1	1	2	1	1	3	3	3	2	2	4	1	1	1
10	10	Adopted "Bookkeeping Without Books?"	No	No	No	No	No	No	No	No	No	No	No	No	See Notes	No	No	No	No	No	No	Yes	No	No
11	13	Are Merchandise Sales entered on Gas Bill?	Yes	No	No	See Notes	Yes	Yes	See Notes	No	Yes	No	See Notes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes
12	14	Are Merchandise Sales Collected same time as gas bill?	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No	See Notes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes
13	15	Total Merchandise Sales for period	$2,658,166.63		$101,623.09	$191,201.94	$350,000.00	$113,470.02	$19,357.21	$85,086.45	$311,974.22	See Notes	See Notes	$73,101.92	$538,385.61	See Notes	See Notes	See Notes	See Notes	See Notes	See Notes	$106,778.49	$31,745.69	$41,192.28
14		Total Merchandise Average per meter	3.88		2.76	2.76	2.71	8.40	.777	.343	3.97	See Notes	See Notes	.363	4.377	See Notes	See Notes	See Notes	See Notes	See Notes	See Notes	.401	5.262	2.188
15	761-1	Commercial General Labor Costs (Average per meter)											See Notes											
16		G. R.—Gas Regular Meters	.351	N-S		.932	.188	.717	.371	Reporting			.196	.563		1.04	.964	1.124	1.021	1.004	1.070	.505	1.18	1.056
17		G. P.—Gas Prepay Meters	——	N-S																		.375	.208	.945
18		T. G.—Total Gas Meters	.351	.304	.311	.932	.188	.717	.371		.406	.148			?					1.004	1.070	.466	1.152	.105
19		Mdse.—Total Merchandise Accounts			.073					Company												.045	.119	.075
20		G. M.—Total Gas Meters and Merchandise																		1.004	1.070	.510	1.272	
21		Elec.—Electric Meters							.332			.145	.104	.532		1.026	.917	1.144	.845	.997	.898			.901
22		G. E.—Gas & Electric Meters							.360	State		.146	.160		.504		.939	1.133	.924	1.00	.967			.970
23		G. E. M.—Gas & Electric Meters & Merchandise accounts	.351	.304	.384	.932	.188	.717	.373		.406	.146	.160	.551	.504	1.030	.939	1.133	.924	1.00	.967	.510	1.27	1.045
24	761-21	Commercial Bookkeeping Labor Costs (Average per meter)																						
25		G. R.—Gas Regular Meters	.611			.381	.261	.467	.196	"No Figures"			.303	.711								.185	.249	.421
26		G. P.—Gas Prepay Meters																				.117	.578	.567
27		T. G.—Total Gas Meters	.611	.606	.442	.381	.261	.467	.196		.951	.288				See Notes	See Notes	See Notes	See Notes	See Notes	See Notes	.164	.259	.430
28		Elec.—Electric Meters							.300	for		.265	.539	.671										.377
29		G. E.—Total Gas & Electric Costs	.611	.606	.442	.381	.261	.467	.253		.951	.276	.436	.697	.490							.164	.259	.401
30	761-22	Commercial Contract Labor Costs (Average per meter)																						
31		G. R.—Gas Regular Meters	.195			.070	.260	.200	.014	these			.071	.156								.074	No	.095
32		G. P.—Gas Prepay Meters															See Notes	See Notes	See Notes	See Notes	See Notes	.061		.038
33		T. G.—Total Gas Meters	.195	.109	.074	.070	.260		.014		.150	.031				See Notes						.061	Figures	.092
34		Elec.—Electric Meters							.035	Accounts		.054	.049	.148										.081
35		G. E.—Total Gas & Electric Costs	.195	.109	.074	.076	.260		.025		.150	.054	.064	.153	.093							.061	Given	.086
36	761-31A	Commercial Collecting Labor Costs (Average per meter)																						
37		G. R.—Gas Regular Meters	.569			.247	.461	.576	.070				.237	.342		.263	.283	.423	.437	.257	.251	.153	.164	.605
38		G. P.—Gas Prepay Meters																				.305	.434	.851
39		T. G.—Total Gas Meters	.569	.446	.133	.247	.461	.576	.070	.403	.412	.147	.237	.342		.263	.283	.423	.437	.257	.251	.200	.172	.620
40		Elec.—Electric Meters							.081			.237	.208	.255		.182	.212	.399	.393	.287	.366			.559
41		G. E.—Total Gas & Electric Costs	.569	.446	.133	.247	.461	.576	.077	.403	.412	.194	.235	.311	.177	.221	.244	.399	.393	.274	.321	.200	.172	.587
42	761-31B	Commercial Bill Delivery Labor Costs (Average per meter)																						
43		G. R.—Gas Regular Meters	.073			.075	.047	.351	.029	.064	.083	.054	.064	.026			See Notes	See Notes	See Notes	See Notes	See Notes	.097	.061	.065
44		G. P.—Gas Prepay Meters																						
45		T. G.—Total Gas Meters	.073	See Notes	See Notes	.075	.047	.351	.029	.064	.083	.054	.064	.047		See Notes								
46		Elec.—Electric Meters							.022			.054	.058	.021										.054
47		G. E.—Total Gas & Elec. Costs	.073			.075	.047	.351	.027	.064	.083	.054	.164	.024	.073							.097	.061	.057
48	761-32A	Meter Reading Labor Costs (Average per meter)																						
49		G. R.—Gas Regular Meters	.617			.246	.245	.308	.120	.490			.229	.280		.314	.295	.259	.267	.270	.278	.267	.334	.421
50		G. P.—Gas Prepay Meters																				.134	.145	.851
51		T. G.—Total Gas Meters	.617	.196	.197	.246	.245	.308	.120	.490	.293	.163	.229	.280		.314	.295	.259	.267	.270	.278	.226	.328	.447
52		Elec.—Electric Meters							.115			.144	.299	.174		.287	.263	.207	.201	.306	.218			.451
53		G. E.—Total Gas & Electric Costs (Average per meter)	.617	.196	.197	.246	.245	.308	.120	.490	.293	.153	.276	.241	.378	.300	.278	.207	.201	.291	.242	.226	.328	.449
54	761-4	Commercial Supplies and Expense Costs (Average per meter)																						
55		Regular Gas Meters—Office Items G. R.—A	.111		.267	.779	.098	.592	.260				.207									.286	.395	.318
56		" " " —Meter Reading G. R.—B	.004	N-S	.025	.047	.028	.022	.017				.027									.039	.006	.027
57		" " " —Bill Delivery G. R.—C	.016			.018	.015	.008	.002				.002									.005		.048
58		" " " —Collecting G. R.—D	.021		.024	.054	.063	.030	.008				.012									.733	.017	.078
59		" " " —Total G. R.—E	.152		.316	.898	.204	.119	.288				.249	.425		323	.333	.454	.303	.393	.454	.403	.418	.423

[1]See notes for answers to questions 9 and 11; No. 12 is merely explanatory. See questionnaire.

COST DATA ON CUSTOMERS' ACCOUNTING

Companies' Reference Code Numbers

Line No.	Questionnaire No.	ITEMS	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
1	5	Average Number Meters in Use, 1922																						
2		Gas, Regular (G. R.)	2,767	3,102	19,775	8,568	8,851	22,271	8,693	17,911	14, 875	11,946	3,600	14,237	16,078	21,825	6,629	3,518	1,055	1,139	7,540	12,500	5,012	45,103
3		Gas, Prepay (G. P.)	446	1,455	3,987	1,832	1,338	6,807		6,638	255			1,706	5,067	136		3,696	2,302	936	2,118	3,000	682	
4		Gas, Total (F. G.)	3,213	4,557	23,762	10,400	10,189	29,078	8,693	24,549	15,130	11,946	3,600	15,943	21,145	21,961	6,629	7,214	3,357	2,075	9,658	15,500	5,694	45,103
5		Electric (Elec.)				8,972	7,512		9,465					16,721			6,014					13,000		32,425
6		Grand Total Meters in Use	3,213	4,557	23,762	19,372	17,701	29,078	18,158	24,549	15,130	11,946	3,600	32,664	21,145	21,961	12,643	7,214	3,357	2,075	9,658	28,500	5,694	77,528
7	6	Meter Readers report at how many offices?	2	1	1	1	2	1	4	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
8	7	Collectors report at how many offices?	1	1	1	1	2	1	4	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
9	8	Books are kept at how many offices?	1	1	1	1	1	1	4	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
10	10	Adopted "Bookkeeping Without Books"?	No	No	Yes	No	See Notes	No	No	Yes	No	See Notes	No	No	No	No	No	No	No	No	No	No	No	See Notes
11	13	Are Merchandise Sales entered on Gas Bill?	Yes	Yes	No	Yes	No	No	No	Yes	See Notes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	See Notes	No
12	14	Are Merchandise Sales collected same time as gas bill?	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No
13	15	Total Merchandise Sales for period	——	$30,901.26	$116,725.10	$112,096.08	$81,924.35	$125,000.00	$56,050.44	$103,634.63	$42,731.10	$171,791.84	$9,676.55	$79,698.34	$99,679.91	$132,079.31	$67,660.16	$13,691.08	$20,833.51	$14,550.07	$43,054.14	$96,189.42	$6,846.34	$206,012.00
14		Total Merchandise Average per meter	——	6.78	4.913	.586	4.629	4.299	3.086	4.221	2.824	14.381	2.687	2.134	4.713	.601	5.352	1.898	6.206	7.012	4.458	3.375	1.202	2.657
15	761-1	Commercial General Labor Costs (Average per meter)																						
16		G. R.—Gas Regular Meters	.675		.699	.701	.282	.434	.776	.440	.672	.525	.964	.298	.498	.321	.312	1.421	1.273	.311	.769	.760	.998	
17		G. P.—Gas Prepay Meters	.697		.694	.701	.602	.353		.354				.277	.527			1.623	1.166	.302	.472	.267	.432	
18		T. G.—Total Gas Meters	.679		.699	.702	.324	.415	.776	.417	.661	.525	.964	.296	.505	.319	.316	1.525	1.200	.307	.704	.665	.930	.309
19		Mdse.—Total Merchandise Accounts	.429		.068	.069	.154	.041	.116	.054	.067	.121	.25	.005	.042	.044	.049	.069	.089	.034	.083	.018		
20		G. M.—Total Gas Meters and Merchandise	1.108	1.241	.792		.341	.456		.471		.645	1.214	.306	.548	.362	.212	1.594	1.289	.341	.787	.379		
21		Elec.—Electric Meters				.510	.096		.689					.281			.526					.923		.397
22		G. E.—Gas & Electric Meters				.613	.397		.106			.645		.288			.413					.782		
23		G. E. M.—Gas & Electric Meters & Merchandise accounts	1.108	1.241	.792	.684	.551	.456	.118	.471	.728	.645	1.214	.293	.548	.362	.462	1.594	1.289	.341	.787	.800	.263	.348
24	761-21	Commercial Bookkeeping Labor Costs (Average per meter)																						
25		G. R.—Gas Regular Meters	.675		.430	.373	.222	.323	.161	.279	.292	.913	.333	.209	.498	.364	.288	1.421	.398	1.317	.343	.360	.519	
26		G. P.—Gas Prepay Meters	.697	No	.301	.359	.447	.194		.271	.392			.193	.527			1.082	.364	.855	.340	.400	1.466	
27		T. G.—Total Gas Meters	.679		.409	.370	.252	.293	.161	.277	.293	.913	.333	.207	.505	.362	.288	1.248	.375	1.108	.342	.368	.632	.530
28		Elec.—Electric Meters		Figures		.302	.236		.282					.196			.368					.346		.679
29		G. E.—Total Gas & Electric Costs	.746		.409	.339	.245	.293	.224	.277	.293	.913	.333	.202	.505	.362	.326	1.248	.375	1.108	.342	.358	.632	.592
30	761-22	Commercial Contract Labor Costs (Average per meter)		Given																				
31		G. R.—Gas Regular Meters	Not		No	.150	.089	.212	No	.089	.061	.121	No	.042	.033	.030	.059	.114	No	.169	.179	.048	.160	
32		G. P.—Gas Prepay Meters				.150		.092		.076	.078			.106	.004			.027			.307	.067	.293	
33		T. G.—Total Gas Meters	Applicable	.441	Figures	.150	.077	.184	Figures	.086	.061	.121	Figures	.049	.034	.030	.059	.069	Figures	.093	.207	.052	.176	.164
34		Elec.—Electric Meters				.097	.106							.036			.065					.046		.114
35		G. E.—Total Gas & Electric Costs		.441	Given	.125	.089	.184	Given	.086	.061	.121	Given	.042	.034	.030	.062	.069	Given	.093	.207	.049	.176	.143
36	761-31A	Commercial Collecting Labor Costs (Average per meter)																						
37		G. R.—Gas Regular Meters	.129		.320	.051	.211	.207	.495	.246	.073	.505	.268	.433	.276	.334	.010	.085	.114	.356	.603	.384	.399	
38		G. P.—Gas Prepay Meters	.135	See Notes	.125	.695	.394	.445		.409	.627			.402	.029			.325	.443	.150	.708	.267	.466	
39		T. G.—Total Gas Meters	.130		.287	.164	.235	.262	.495	.290	.082	.505	.268	.430	.279	.332	.010	.208	.339	.263	.626	.361	.407	.332
40		Elec.—Electric Meters				.024	.249		.429					.347			.016					.346		.221
41		G. E.—Total Gas & Electric Costs	.130		.287	.10	.241	.262	.461	.290	.082	.505	.268	.387	.279	.332	.013	.208	.339	.263	.626	.354	.407	.285
42	761-31B	Commercial Bill Delivery Labor Costs (Average per meter)																						
43		G. R.—Gas Regular Meters	.262	No	.038	No	.122	See Notes	No	.060	.097	.120	.071		No	.056	.081	.057	No	.105	.133	.048	.038	No
44		G. P.—Gas Prepay Meters					.808																	
45		T. G.—Total Gas Meters		Figures		Figures	.122		Figures			See Notes	.071	See Notes	Figures				Figures					Figures
46		Elec.—Electric Meters															.073					.046		
47		G. E.—Total Gas & Elec. Costs	.226	Given	.032	Given	.122		Given	.044	.095	.120	.071		Given	.056	.077	.028	Given	.058	.104	.042	.034	Given
48	761-32A	Meter Reading Labor Costs (Average per meter)																						
49		G. R.—Gas Regular Meters	.419	.303	.175	.395	.282	.334	.217	.187	.303	.297	.285	.197	.229	.317	.211	.354	.239	.284	.279	.304	.200	.268
50		G. P.—Gas Prepay Meters	.448		.173	.395	.179	.223		.336	.313			.182	.242			.325	.329	.096	.614	.167	.846	
51		T. G.—Total Gas Meters	.423		.175	.395	.268	.308	.217	.227	.303	.297	.285	.196	.233	.315	.211	.339	.301	.199	.352	.277	.277	.268
52		Elec.—Electric Meters				.302	.503		.276					.339			.204					.288		.276
53		G. E.—Total Gas & Electric Costs (Average per meter)	.423	.303	.175	.352	.367	.308	.248	.227	.303	.297	.285	.269	.233	.315	.207	.339	.301	.199	.352	.282	.277	.272
54	761-4	Commercial Supplies and Expense Costs (Average per meter)																						
55		Regular Gas Meters—Office Items G. R.—A	.956		.165	.290	.303	.171	.325	.319	.336	.749	.827	.406	.385	.264	.143	.113	.729	1.069	.849	.232	.446	
56		" " " —Meter Reading G. R.—B	.056		.011	.042	.063	.020	.008	.015	.016	.041	.003	.155	.004	.128	.023	.085	.027		.023	.044	.011	
57		" " " —Bill Delivery G. R.—C	.117		.073	.197	.039	.090	.059	.001	.010	:120				.05	.030	.085	.256		.053	.004	.010	
58		" " " —Collecting G. R.—D	.108		.046	.151	.039	.044	.055	.032	.007	.083	.002	.049	.004	.046	.025	.057	.024	.009	.172	.120	.159	
59		" " " —Total G. R.—E	1.238		.294	.681	.446	.324	.446	.367	.369	.993	.832	.610	.39	.489	.221	.341	1.036	1.078	1.098	.400	.626	

COST DATA ON CUSTOMERS' ACCOUNTING—Continued

Companies' Reference Code Numbers

Line No.	Questionnaire No.	ITEMS		23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
60		Prepay Gas Meters—Office Costs	G. P.—A	.987		.164	.318	.287	.086		.068	.705			.381	.129			.162	.669	1.100	.850	.233	.293	
61		“ “ “ —Meter Reading	G. P.—B	.058		.011	.044	.047	.027		.015	.059			.144	.001			.027	.024		.035	.033	.029	
62		“ “ “ —Bill Delivery	G. P.—C	.119					.004		.004											.024			
63		“ “ “ —Collecting	G. P.—D	.112		.045	.348	.024	.009		.043				.054	.001			.054	.094	.011	.142	.067	.323	
64		“ “ “ —Total	G. P.—E	1.276		.220	.710	.358	.126		.130	.765			.579	.132			.243	.787	1.110	1.051	.333	.645	
65		Total Gas Meters—Office	T. G.—A	.960		.165	.295	.302	.151	.324	.251	.342	.749	.827	.404	.514	.263	.143	.139	.688	1.083	.849	.232	.427	.166
66		“ “ “ —Meter Reading	T. G.—B	.057		.011	.043	.061	.021	.009	.015	.017	.041	.003	.153	.005	.127	.023	.055	.025		.026	.042	.013	.166
67		“ “ “ —Bill Delivery	T. G.—C	.117		.061	.162	.034	.070	.059	.002	.010	.120				.05	.030	.042	.080		.047	.003	.009	.166
68		“ “ “ —Collecting	T. G.—D	.109		.046	.186	.037	.036	.055	.035	.007	.083	.002	.050	.005	.05	.025	.055	.072	.010	.166	.109	.179	.166
69		“ “ “ —Total	T. G.—E	1.243		.282	.368	.434	.278	.446	.303	.376	.993	.832	.607	.524	.486	.221	.291	.865	1.093	1.087	.387	.628	.665
70		Merchandise Accts.—Office	Mdse.—A	.612		.055	.026	.086	.004	.007	.022		.025	.049	.028	.009	.023	.016	.042	.037	.539	.072	.035	.035	.003
71		“ “ —Meter Reading	Mdse.—B																						.003
72		“ “ —Bill Delivery	Mdse.—C	.097			.012		.008	.006	.004								.014	.009		.005	.001		.003
73		“ “ —Collecting	Mdse.—D	.016		.015	.010	.009	.004	.004	.007				.003	.001	.005		.014	.006	.053	.041	.007		.005
74		“ “ —Total	Mdse.—E	.725		.070	.049	.095	.017	.016	.034		.025		.031	.011	.027	.016	.069	.052	.592	.119	.043	.035	.013
75		Gas Meter & Mdse. Acts.—Office Costs	G. M.—A	1.573	.569	.220		.260	.155	.162	.273	.342	.774	.876	.225	.524	.286	.091	.180	.725	1.622	.922	.161		.171
76		“ “ “ “ —Meter Reading	G. M.—B	.057		.011		.035	.021	.004	.015	.017	.041	.003	.075	.005	.127	.012	.055	.025		.026	.023		.171
77		“ “ “ “ —Bill Delivery	G. M.—C	.214		.061		.020	.078	.034	.006	.010	.120				.05	.016	.055	.089		.052	.003		.171
78		“ “ “ “ —Collecting	G. M.—D	.124	.041	.061		.030	.040	.030	.042	.007	.080	.002	.027	.006	.05	.013	.069	.078	.063	.207	.067		.174
79		“ “ “ “ —Total	G. M.—E	1.969	.611	.035		.346	.294	.229	.337	.376	1.018	.881	.327	.534	.513	.132	.360	.917	1.685	1.206	.254		.687
80		Electric Meters—Office	Elec.—A				.167	.404		.446					.566			.349					.285		.247
81		“ “ —Meter Reading	Elec.—B				.057	.227		.012					.189			.033					.048		.247
82		“ “ —Bill Delivery	Elec.—C				.126	.046		.081								.033					.004		.247
83		“ “ —Collecting	Elec.—D				.120	.046		.051					.057			.024					.108		.194
84		“ “ —Total	Elec.—E				.470	.724		.590					.812			.439					.445		.934
85		Gas & Electric Meters—Office	G. & E.—A				.236	.345		.388				.827	4.87			.241			1.083		.256		
86		“ “ “ —Meter Reading	G. & E.—B				.049	.132		.011				.003	.171			.028					.045		
87		“ “ “ —Bill Delivery	G. & E.—C				.146	.039		.070								.032					.004		
88		“ “ “ —Collecting	G. & E.—D				.155	.041		.052				.002	.053			.025			.010		.109		
89		“ “ “ —Total	G. & E.—E				.586	.558		.521				.832	.712			.325			1.092		.413		
90		Gas & Elec. Meters & Mdse.—Office	G. E. M.—A				.261	.432		.395		.342		.876	.514		.286	.257		.725	1.622		.291	.462	.202
91		“ “ “ “ —Meter Reading	G. E. M.—B				.049	.132		.011		.017		.003	.171		.127	.028		.025			.045	.013	.202
92		“ “ “ “ —Bill Delivery	G. E. M.—C				.158	.039		.076		.010					.050	.032		.089			.004	.009	.202
93		“ “ “ “ —Collecting	G. E. M.—D				.166	.050		.057		.007		.002	.056		.050	.025		.078	.063		.116	.179	.183
94		“ “ “ “ —Total	G. E. M.—E				.634	.653		.537		.376		.881	.742		.513	.341		.917	1.685		.456	.663	.790
95	614	Merchandise and Jobbing Costs	(Per meter)																						
96		A X—Order Writing—Labor Costs	“					.017			.086	.026		.028	.061	.034	.074	.078	.055		.096	.021	.018		
97		A Y— “ “ —Supplies and Expenses	“					.009			.009	.007		.006	.006	.009	.005	.008	.014		.154	.041	.011		
98		A Z— “ “ —Total	“					.026		None	.095	.033		.033	.067	.044	.078	.086	.069		.250	.062	.028		
99		B X—Billing and Posting—Labor Costs	“				.092	.054	.093		.044	.067	.121	.139	.044	.064	.044	.040	.208	.049	.096	.062	.018		.023
100		B Y— “ “ —Supplies and Expenses	“				.026	.078	.013	Given	.012	.013	.042	.008	.003	.009	.009	.008	.041	.036	.193	.031	.004		——
101		B Z— “ “ —Total	“				.118	.132	.105		.056	.081	.162	.147	.047	.073	.053	.047	.249	.085	.289	.093	.021		.023
102		C X—Collecting—Labor Costs	“	.031			.056	.021	.028		.061	.071	.085		.037	.071	.068	.002	.166	.036	.048	.083	.035	See Notes	.003
103		C Y— “ —Supplies and Expenses	“	.113			.010	.009	.004		.001	.023			.004	.001	.005		.028	.009	.005	.041	.004		——
104		C Z— “ —Total	“	.144			.066	.029	.032		.062	.095	.085		.041	.072	.073	.003	.194	.045	.053	.124	.039		.003
105		D X—Total—Labor Costs	“				.148	.091	.120		.191	.165	.206	.167	.142	.168	.186	.120	.429	.085	.241	.166	.070		.026
106		D Y— “ —Supplies and Expenses	“				.036	.095	.017		.022	.043	.042	.014	.013	.020	.019	.016	.083	.045	.351	.114	.018		——
107		D Z— “ —Total	“				.184	.187	.137		.213	.208	.248	.180	.155	.189	.204	.136	.512	.130	.593	.280	.088		.026
		Summary Labor Costs (All meters G. & E.)																							
108		Line 23 Commercial General Labor		1.108	1.241	.792	.684	.551	.456	1.18	.471	.728	.645	1.214	.293	.548	.362	.462	1.594	1.289	.341	.787	.800	.263	.348
109		Line 29 “ Bookkeeping Labor		——		.409	.339	.245	.293	2.24	.277	.293	.913	.333	.202	.505	.362	.326	1.248	.375	1.108	.342	.358	.632	.592
110		Line 35 “ Contract Labor		——	.441		.125	..089	.184		.086	.061	.121		.042	.034	.030	.062	.069		.093	.207	.049	.176	.143
111		Line 41 “ Collecting Labor		.130		.287	.100	.241	.262	.461	.290	.082	.505	.268	.387	.279	.332	.013	.208	.339	.263	.626	.354	.407	.285
112		Line 47 “ Bill Delivery Labor		.226		.032		.122			.044	.095	.120	.071			.056	.077	.028		.058	.104	.042	.034	
113		Line 53 “ Meter Reading Labor		.423	.303	.175	.352	.367	.308	2.48	.227	.303	.297	.285	.269	.233	.315	.207	.339	.301	.199	.352	.282	.277	.272
114		Total “ Labor		1.887	1.986	1.670	1.600	1.618	1.503	2.11	1.396	1.562	2.60	2.172	1.194	1.60	1.458	1.148	3.486	2.305	2.062	2.418	1.886	1.755	1.638
115		Total “ Supplies and Expenses		1.969	.611	.035	.634	.653	.294	.537	.337	.376	1.018	.881	.742	.534	.513	.341	.360	.917	1.685	1.206	.456	.663	.790
116		Total “ Cost		3.856	2.597	1.705	2.234	2.271	1.797	2.647	1.733	1.938	3.618	3.053	1.936	2.134	1.971	1.489	3.846	3.222	3.747	3.624	2.342	2.418	2.428
117		Merchandising and Jobbing Total Cost per meter		.144	——	——	.184	.187	.137	——	.213	.208	.248	.180	.155	.189	.204	.136	.572	.130	.593	.280	.088	——	.026
118		Grand Total Cost per meter		4.000	2.597	1.705	2.418	2.458	1.934	2.647	1.946	2.146	3.866	3.233	2.091	2.323	2.175	1.625	4.358	3.352	4.340	3.904	2.430	2.418	2.454

[1]See notes for answers to questions 9 and 11; No. 12 is merely explanatory. See questionnaire.

COST DATA ON CUSTOMERS' ACCOUNTING

Companies' Reference Code Numbers

Line No.	Questionnaire No.	ITEMS	45	46	47	48	49	50	51	52	53	54	55
1	5	Average Number Meters in Use, 1922											
2		Gas, Regular (G. R.)	229,079	21,328	10,575	114,139	3,922	26,087	2,696	1,743	13,804	5,293	440
3		Gas, Prepay (G. P.)		122	515		5,654	11,555	813	110	34,172	6,393	4,478
4		Gas, Total (T. G.)	229,079	21,450	11,090		9,576	37,642	3,509	1,853	47,976	11,686	4,918
5		Electric (Elec.)		31,094	3,159		6,941		4,433	8,164		9,180	5,512
6		Grand Total Meters in Use	229,079	52,544	14,249	114,139	16,517	37,642	7,942	10,017	47,976	20,866	10,430
7	6	Meter Readers report at how many offices?	1	1	3	1	1	1	1	3	1	1	1
8	7	Collectors report at how many offices?	1	1	3	1	1	1	1	——	1	1	1
9	8	Books are kept at how many offices?	1	1	1	1	1	1	1	1	1	1	1
10	10	Adopted "Bookkeeping Without Books"?	No	No	No	No	No	No	No	No	No	No	No
11	13	Are Merchandise Sales entered on Gas Bill?	See Notes	See Notes	No	No	Yes	No	No	No	No	Yes	Yes
12	14	Are Merchandise Sales Collected same time as gas bill?	See Notes	Yes	No	Yes	Yes	No	Yes	No	Yes	No	Yes
13	15	Total Merchandise Sales for period	$643,525.27	——	$30,631.08	$295,612.82	$105,168.51	$154,191.82	$11,580.56	$9,138.47	$132,813.00	$34,427.29	$28,750.00
14		Total Merchandise Average per meter	2.809	——	2.150	2.590	6.367	4.096	1.46	.912	2.768	1.650	2.76
15	761-1	Commercial General Labor Costs (Average per meter)											
16		G. R.—Gas Regular Meters	.524			.417	.367	.782	.421	.417		.529	
17		G. P.—Gas Prepay Meters						.179	.631	.505		.406	
18		T. G.—Total Gas Meters					.150	.597	.47	.423	.378	.461	See Notes
19		Mdse.—Total Merchandise Accounts					.022		.120	.123		.051	
20		G. M.—Total Gas Meters and Merchandise		.217	.705		.188		.742	.148		.553	
21		Elec.—Electric Meters		.449	.389		.578		.515	.263		1.519	
22		G. E.—Gas & Electric Meters			.635		.330		.494	.292		.927	
23		G. E. M.—Gas & Electric Meters & Merchandise accounts	.524	.354	.635	.417	.439	.597	.615	.416	.378	.978	
24	761-21	Commercial Bookkeeping Labor Costs (Average per meter)											
25		G. R.—Gas Regular Meters	.736			.366	.493	.249	.439	.368	.373	.859	
26		G. P.—Gas Prepay Meters					.138	.075	.424	.36	.060	.854	
27		T. G.—Total Gas Meters		.466	.725		.283	.196	.435	.356	.150	.856	.456
28		Elec.—Electric Meters		.964	1.291		.283		.464	.195		1.024	.959
29		G. E.—Total Gas & Electric Costs	.736	.760	.851	.366	.283	.196	.451	.224	.150	.930	.722
30	761-22	Commercial Contract Labor Costs (Average per meter)											
31		G. R.—Gas Regular Meters	.103			.112	.036	.032	.058	.066		.042	
32		G. P.—Gas Prepay Meters					.039			.067		.038	
33		T. G.—Total Gas Meters		.128	.104		.038	.022	.044	.066	.048	.040	See Notes
34		Elec.—Electric Meters		.264			.008		.035	.068		.040	
35		G. E.—Total Gas & Electric Costs	.103	.209	.081	.112	.038	.022	.039	.068	.048	.040	
36	761-31A	Commercial Collecting Labor Costs (Average per meter)											
37		G. R.—Gas Regular Meters	.522			.203	.215	.093	.211	.10	.174	.289	
38		G. R.—Gas Prepay Meters					.182	.427	.385	.10	.533	.541	See Notes
39		T. G.—Total Gas Meters		.073	.468		.196	.196	.251	.10	.430	.427	
40		Elec.—Electric Meters		.098	.399		.182		.157	.136		.414	
41		G. E.—Total Gas & Electric Costs	.522	.087	.453	.203	.190	.196	.198	.123	.430	.421	
42	761-31B	Commercial Bill Delivery Labor Costs (Average per meter)											
43		G. R.—Gas Regular Meters	.058	.035	.037	.078	.035	.081	.031	.095	.064	.029	See Notes
44		G. P.—Gas Prepay Meters											
45		T. G.—Total Gas						.056					
46		Elec.—Electric Meters		.071			.040		.025	.128		.033	
47		G. E.—Total Gas & Elec. Costs	.058	.056	.028	.078	.025	.056	.024	.039	.018	.022	
48	761-32A	Meter Reading Labor Costs (Average per meter)											
49		G. R.—Gas Regular Meters	.243			.213	.243	.384	.297	.801	.330	.330	
50		G. P.—Gas Prepay Meters					.071	.400	.246	.809		.321	
51		T. G.—Total Gas Meters		.101	.457		.141	.389	.285	.802	.095	.325	.373
52		Elec.—Electric Meters		.211	.519		.249		.226	.547		.372	.340
53		G. E.—Total Gas & Electric Costs (Average per meter)	.243	.166	.471	.213	.187	.389	.252	.594	.095	.346	.355
54	761-4	Commercial Supplies and Expense Costs (Average per meter)											
55		Regular Gas Meters—Office Items G. R.—A	.128			.126	.391	.472	.125	.076		.212	
56		" " " —Meter Reading G. R.—B	.017			.010	.045	.112	.028			.088	
57		" " " —Bill Delivery G. R.—C	.015			.010	.085		.148			.103	
58		" " " —Collecting G. R.—D	.062			.016	.050	.301	.042			.022	
59		" " " —Total G. R.—E	.221			.162	.571	.885	.342	.076		.430	

Line No.	Questionnaire No.	ITEMS	56	57	58	59	60	61	62	63	64	65	66
1	5	Average Number Meters in Use, 1922											
2		Gas, Regular (G. R.)	10,872	2,038	1,530	2,151	1,568	10,198	10,148	16,572	28,946	513,785	2,721
3		Gas, Prepay (G. P.)	3,229	396	940	85	517			146	1,482	59,187	135
4		Gas, Total (T. G.)	14,101	2,434	2,470	2,236	2,085	10,198	10,148	16,718	30,428	572,972	2,856
5		Electric (Elec.)		4,662	5,800	5,311	4,429	11,363					51,123
6		Grand Total Meters in Use	14,101	7,096	8,270	7,547	6,514	21,561	10,148	16,718	30,428	572,972	53,979
7	6	Meter Readers report at how many offices?	1	1	1	1	1	1	1	1	1	24	4
8	7	Collectors report at how many offices?	1	1	1	1	1	1	1	1	1	24	4
9	8	Books are kept at how many offices?	1	1	1	1	1	1	1	1	1	24	4
10	10	Adopted "Bookkeeping Without Books"?	No	No	No	No	No	No	——	No	No	No	No
11	13	Are Merchandise Sales entered on Gas Bill?	Yes	Yes	No	Yes	Yes	No	See Notes	See Notes	No	Yes	No
12	14	Are Merchandise Sales Collected same time as gas bill?	Yes	Yes	No		Yes	Yes	Yes	Yes	See Notes	Yes	No
13	15	Total Merchandise Sales for period	$75,174.00	$38,940.97	$26,926.11	$10,704.48	$31,992.29	$152,580.89	$12,600.00	$58,981.97	$141,768.77	$1,865,274.00	$105,963.36
14		Total Merchandise Average per meter	5.331	5.49	3.26	1.42	4.91	7.077	1.24	3.56	4.66	3.255	1.963
15	761-1	Commercial General Labor Costs (Average per meter)											
16		G. R.—Gas Regular Meters							456	.177		.414	
17		G. P.—Gas Prepay Meters										.308	
18		T. G.—Total Gas Meters		See Notes		.103	See Notes				See Notes	.403	See Notes
19		Mdse.—Total Merchandise Accounts										.031	
20		G. M.—Total Gas Meters and Merchandise						.271				.434	
21		Elec.—Electric Meters				.10		.244					
22		G. E.—Gas & Electric Meters											.501
23		G. E. M.—Gas & Electric Meters & Merchandise accounts	See Notes		See Notes	.10	See Notes	.257	.456	.177	See Notes	.434	
24	761-21	Commercial Bookkeeping Labor Costs (Average per meter)											
25		G. R.—Gas Regular Meters						.575	.452	.276		.416	
26		G. P.—Gas Prepay Meters										.415	
27		T. G.—Total Gas Meters		.205	1.761	.373		.575		.276		.416	
28		Elec.—Electric Meters	See Notes	.246	1.608	.378	See Notes	.707					
29		G. E.—Total Gas & Electric Costs		.232	1.654	.374		.645		.276		.416	.599
30	761-22	Commercial Contract Labor Costs (Average per meter)											
31		G. R.—Gas Regular Meters		.224				.074	.124	.05		.066	
32		G. P.—Gas Prepay Meters										.066	
33		T. G.—Total Gas Meters	See Notes		1.645	.207	See Notes	.074		.05	See Notes	.066	See Notes
34		Elec.—Electric Meters		.117	2.390	.149		.067					
35		G. E.—Total Gas & Electric Costs		.153	2.167	.163		.070	.124	.05		.066	
36	761-31A	Commercial Collecting Labor Costs (Average per meter)											
37		G. R.—Gas Regular Meters						.150	.057	.07		.276	
38		G. R.—Gas Prepay Meters	See Notes		See Notes						See Notes	.35	
39		T. G.—Total Gas Meters		.31		.268	3.143	.150				.284	
40		Elec.—Electric Meters		.426		.237	3.000	.134		.07			
41		G. E.—Total Gas & Electric Costs		.386		.246	3.046	.141	.057	.07		.284	.446
42	761-31B	Commercial Bill Delivery Labor Costs (Average per meter)											
43		G. R.—Gas Regular Meters		No	See Notes		See Notes	.055	.083	.058		.151	
44		G. P.—Gas Prepay Meters				See Notes							See Notes
45		T. G.—Total Gas	2.20	Figures								.135	
46		Elec.—Electric Meters						.050					
47		G. E.—Total Gas & Elec. Costs	2.20	Given				.052	.083	.058	.874	.135	
48	761-32A	Meter Reading Labor Costs (Average per meter)											
49		G. R.—Gas Regular Meters	.319					.20	.386	.263	.218	.156	
50		G. P.—Gas Prepay Meters	.319								.219	.35	
51		T. G.—Total Gas Meters	.319	.237	.147	.312	.327	.20		.263		.175	
52		Elec.—Electric Meters		.378	.382	.264	.359	.177					
53		G. E.—Total Gas & Electric Costs (Average per meter)	.319	.33	.392	.278	.349	.188	.386	.263	.218	.175	340
54	761-4	Commercial Supplies and Expense Costs (Average per meter)											
55		Regular Gas Meters—Office Items G. R.—A						.162	.301	.156		.184	
56		" " " —Meter Reading G. R.—B						.020	.027	.012		.019	
57		" " " —Bill Delivery G. R.—C						.017	.012	.016		.024	
58		" " " —Collecting G. R.—D						.013	.012	.126		.039	
59		" " " —Total G. R.—E						.212		.310		.272	

COST DATA ON CUSTOMERS' ACCOUNTING—Continued

Companies' Reference Code Numbers

Line No.	Question-naire No.	ITEMS		45	46	47	48	49	50	51	52	53	54	55
60		Prepay Gas Meters—Office Costs	G. P.—A					.035	.492	.192			.221	
61		" " " —Meter Reading	G. P.—B					.048	.116	.063			.090	
62		" " " —Bill Delivery	G. P.—C							.148			.103	
63		" " " —Collecting	G. P.—D						.215	.039			.019	
64		" " " —Total	G. P.—E					.083	.823	.439			.432	
65		Total Gas Meters—Office	T. G.—A		.220	.632		.181	.478	.140	.071	.298	.219	
66		" " " —Meter Reading	T. G.—B		.030	.071		.047	.113	.036		.088	.090	
67		" " " —Bill Delivery	T. G.—C		.035			.035		.148			.103	
68		" " " —Collecting	T. G.—D		.044	.034		.021	.275	.041		.015	.020	
69		" " " —Total	T. G.—E		.331	.737		.283	.866	.365	.071	.401	.431	.016
70		Merchandise Accts.—Office	Mdse.—A					.016		.009			.153	
71		" " —Meter Reading	Mdse.—B											
72		" " —Bill Delivery	Mdse.—C					.012		.008				
73		" " —Collecting	Mdse.—D					.010		.006			.032	
74		" " —Total	Mdse.—E					.038		.022			.185	
75		Gas Meter & Mdse. Accts.—Office Costs	G. M.—A					.196		.160			.246	
76		" " " " —Meter Reading	G. M.—B					.047		.359			.090	
77		" " " " —Bill Delivery	G. M.—C					.047		.165			.103	
78		" " " " —Collecting	G. M.—D					.031		.540			.026	
79		" " " " —Total	G. M.—E					.321		.415			.464	
80		Electric Meters—Office	Elec.—A		.440	.632		.428		.189	.265		.131	
81		" " —Meter Reading	Elec.—B		.061	.085		.113		.048			.031	
82		" " —Bill Delivery	Elec.—C		.074			.096		.196			.029	
83		" " —Collecting	Elec.—D		.042	.034		.053		.059			.010	
84		" " —Total	Elec.—E		.617	.750		.690		.493	.265		.201	.017
85		Gas & Electric Meters—Office	G. & E. —A			.632		.285		.168	.066		.253	
86		" " " —Meter Reading	G. & E.—B			.074		.075		.043			.081	
87		" " " —Bill Delivery	G. & E.—C					.061		.175			.086	
88		" " " —Collecting	G. & E.—D			.033		.034		.051			.024	
89		" " " —Total	G. & E.—E			.740		.454		.436	.066		.445	
90		Gas & Elec. Meters & Mdse.—Office	G. E. M.—A	.128	.351			.294		.176			.269	
91		" " " " —Meter Reading	G. E. M.—B	.017	.048			.075		.043			.081	
92		" " " " —Bill Delivery	G. E. M.—C	.015	.058			.068		.182			.087	
93		" " " " —Collecting	G. E. M.—D	.062	.043			.040		.057			.024	
94		" " " " —Total	G. E. M.—E	.221	.500			.476		.458			.460	.016
95	614	Merchandise and Jobbing Costs	(Per $ of sales)											
96		A X—Order Writing—Labor Costs	"	.005			.006	.009	.008	.003		.017	.025	
97		A Y— " " —Supplies and Expenses	"	.002				.003		.002			.060	
98		A Z— " " —Total	"	.007			.006	.012	.008	.004		.017	.031	
99		B X—Billing and Posting—Labor Costs	"	.036			.119	.050	.041	.013		.064	.090	
100		B Y— " " —Supplies and Expenses	"	.007				.012		.006			.014	
101		B Z— " " —Total	"	.043			.119	.062	.041	.019		.064	.104	
102		C X—Collecting—Labor Costs	"	.011				.018	.019	.012		.050	.051	See Notes
103		C Y— " —Supplies and Expenses	"					.012		.006		.015	.003	
104		C Z— " —Total	"	.011				.030	.019	.018		.064	.054	
105		D X—Total—Labor Costs	"	.052			1.110	.007	.068	.028		.131	.165	
106		D Y— " —Supplies and Expenses	"	.009				.027		.014		.015	.024	
107		D Z— " —Total Expenses	"	.061			1.010	.104	.068	.041		.145	.189	
		Summary Labor Costs (All meter G & E)												
108		Line 23 Commercial General Labor		.524	.354	.635	.417	.439	.597	.615	.416	.378	.978	
109		Line 29 " Bookkeeping Labor		.736	.760	.851	.366	.283	.196	.451	.224	.150	.930	.722
110		Line 35 " Contract Labor		.103	.209	.081	.112	.038	.022	.039	.068	.048	.040	
111		Line 41 " Collecting Labor		.522	.087	.453	.203	.190	.196	.198	.130	.430	.421	
112		Line 47 " Bill Delivery Labor		.058	.056	.028	.078	.025	.056	.024	.039	.018	.022	
113		Line 53 " Meter Reading Labor		.243	.166	.471	.213	.187	.389	.252	.594	.095	.346	.355
114		Total " Labor		2.184	1.633	2.518	1.390	1.162	1.455	1.58	1.471	1.119	2.737	1.08
115		Total " Supplies and Expenses		.221	.50	.74	.162	.476	.866	.458	.066	.401	.460	.016
116		Total " Costs		2.405	2.133	3.258	1.552	1.638	2.321	2.038	1.537	1.520	3.197	1.096
117		Merchandising and Jobbing, Total Cost per meter		.061	—	—	1.01	.104	.068	.041	—	.145	.189	—
118		Grand Total Cost per meter		2.466	2.133	3.258	2.562	1.742	2.389	2.079	1.537	1.665	3.386	1.096

Line No.	Question-naire No.	ITEMS		56	57	58	59	60	61	62	63	64	65	66
60		Prepay Gas Meters—Office Costs	G. P.—A										.150	
61		" " " —Meter Reading	G. P.—B										.019	
62		" " " —Bill Delivery	G. P.—C											
63		" " " —Collecting	G. P.—D										.031	
64		" " " —Total	G. P.—E										.201	
65		Total Gas Meters—Office	T. G.—A						.162	.301			.184	
66		" " " —Meter Reading	T. G.—B	.043					.020	.027		.026	.019	
67		" " " —Bill Delivery	T. G.—C						.017	.012			.024	
68		" " " —Collecting	T. G.—D	.695					.013	.012		.160	.039	
69		" " " —Total	T. G.—E	.738	.373				.212			.186	.263	
70		Merchandise Accts.—Office	Mdse.—A										.015	
71		" " —Meter Reading	Mdse.—B											
72		" " —Bill Delivery	Mdse.—C										.002	
73		" " —Collecting	Mdse.—D										.003	
74		" " —Total	Mdse.—E										.020	
75		Gas Meter & Mdse. Accts.—Office Costs	G. M.—A				See Notes	See Notes	.162				.199	
76		" " " " —Meter Reading	G. M.—B	.043					.020				.019	
77		" " " " —Bill Delivery	G. M.—C						.017				.005	
78		" " " " —Collecting	G. M.—D	.695					.013				.042	
79		" " " " —Total	G. M.—E	.738		2.036			.212				.284	
80		Electric Meters—Office	Elec.—A						.157					
81		" " —Meter Reading	Elec.—B						.022					
82		" " —Bill Delivery	Elec.—C						.015					
83		" " —Collecting	Elec.—D						.011					
84		" " —Total	Elec.—E		.360	1.620			.205					
85		Gas & Electric Meters—Office	G. & E. —A											
86		" " " —Meter Reading	G. & E.—B											
87		" " " —Bill Delivery	G. & E.—C											
88		" " " —Collecting	G. & E.—D											
89		" " " —Total	G. & E.—E											
90		Gas & Elec. Meters & Mdse.—Office	G. E. M.—A						.159		.156			
91		" " " " —Meter Reading	G. E. M.—B						.021		.012			
92		" " " " —Bill Delivery	G. E. M.—C						.016		.016			
93		" " " " —Collecting	G. E. M.—D						.012		.126			
94		" " " " —Total	G. E. M.—E		.365	1.745			.208		.310			.522
95	614	Merchandise and Jobbing Costs	(Per $ of sales)											
96		A X—Order Writing—Labor Costs	"						.014		.044		.065	
97		A Y— " " —Supplies and Expenses	"						.006				See Notes	
98		A Z— " " —Total	"				.163		.019		.044		.065	
99		B X—Billing and Posting—Labor Costs	"						.052		.032		.067	
100		B Y— " " —Supplies and Expenses	"						.012					
101		B Z— " " —Total	"				.374		.064		.032		.067	
102		C X—Collecting—Labor Costs	"					See Notes				See Notes	.035	See Notes
103		C Y— " —Supplies and Expenses	"						See Notes				See Notes	
104		C Z— " —Total	"				.246						.035	
105		D X—Total—Labor Costs	"						.066		.076		.167	
106		D Y— " —Supplies and Expenses	"						.018				See Notes	
107		D Z— " —Total Expenses	"				.783		.083		.076		.167	
		Summary Labor Costs (All meter G & E)												
108		Line 23 Commercial General Labor			—		.10		.257	.456	.177		.434	.501
109		Line 29 " Bookkeeping Labor			.232	1.654	.374		.645	.452	.276		.416	.599
110		Line 35 " Contract Labor		See Notes	.153	2.167	.163		.070	.124	.05		.066	—
111		Line 41 " Collecting Labor			.386		.246	3.046	.141	.057	.07		.284	.446
112		Line 47 " Bill Delivery Labor		2.20	—		—		.052	.083	.058	.874	.135	—
113		Line 53 " Meter Reading Labor		.319	.33	.392	.278	.349	.188	.386	.263	.218	.175	.340
114		Total " Labor		2.440	1.101	4.213	1.162	3.395	1.353	1.558	.835	1.092	1.509	1.886
115		Total " Supplies and Expenses		.738	.365	1.745	—		.208	.012	.310	.186	.284	.522
116		Total " Costs		3.178	1.466	5.958	1.162	3.395	1.561	1.570	1.145	1.278	1.793	2.408
117		Merchandising and Jobbing, Total Cost per meter		—	—	—	.783		.083	—	.076	—	.167	
118		Grand Total Cost per meter		3.178	1.466	5.958	1.945	3.395	1.644	1.570	1.221	1.278	1.960	2.403

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[1]See notes for answers to questions 9 and 11; No. 12 is merely explanatory. See questionnaire.

COST DATA ON CUSTOMERS' ACCOUNTING

Companies' Reference Code Numbers

Line No.	Questionnaire No.	ITEMS	67	68	69	70	71	72	73
1	5	Average Number Meters in Use, 1922							
2		Gas, Regular (G. R.)	22,185	2,538	8,589	4,230	38,052	54,189	157,118
3		Gas, Prepay (G. P.)	1,982		705	1,561	95		
4		Gas, Total (T. G.)	24,167	2,538	9,294	5,791	38,147	54,189	157,118
5		Electric (Elec.)		7,172	22,267	12,657		38,591	101,362
6		Grand Total Meters in Use	24,167	9,710	31,561	18,448	38,147	92,780	258,480
7	6	Meter Readers report at how many offices?	1	1	2	3	1	1	1
8	7	Collectors report at how many offices?	1	See Notes	2	3	1	1	1
9	8	Books are kept at how many offices?	1	1	2	3	1	1	1
10	10	Adopted "Bookkeeping Without Books"?	No	No	No	No	No	No	Yes
11	13	Are Merchandise Sales entered on Gas Bill?	No	No	No	See Notes	No	Yes	Yes
12	14	Are Merchandise Sales Collected same time as gas bill?	No	Yes	No	No	No	Yes	Yes
13	15	Total Merchandise Sales for period	$113,110.05	$4,511.94	$131,293.47	$121,195.99	$91,531.23	$24,159.32	$2,025,497.09
14		Total Merchandise Average per meter	4.68	.465	4.160	6.57	2.40	.260	7.84
15	761–1	Commercial General Labor Costs (Average per meter)							
16		G. R.—Gas Regular Meters		1.272				.393	
17		G. P.—Gas Prepay Meters							
18		T. G.—Total Gas Meters		1.272	See Notes		.696	.393	
19		Mdse.—Total Merchandise Accounts		1.272				.024	
20		G. M.—Total Gas Meters and Merchandise		.672				.435	
21		Elec.—Electric Meters		2.11				.519	
22		G. E.—Gas & Electric Meters		1.891				.446	
23		G. E. M.—Gas & Electric Meters & Merchandise accounts		2.23			.696	.470	.172
24	761–21	Commercial Bookkeeping Labor Costs (Average per meter)							
25		G. R.—Gas Regular Meters		1.244				.539	
26		G. P.—Gas Prepay Meters							
27		T. G.—Total Gas Meters		1.244	See Notes	1.154	.245	.539	
28		Elec.—Electric Meters		1.249		.933		.620	
29		G. E.—Total Gas & Electric Costs		1.248		1.002	.245	.573	.404
30	761–22	Commercial Contract Labor Costs (Average per meter)							
31		G. R.—Gas Regular Meters						.116	
32		G. P.—Gas Prepay Meters							
33		T. G.—Total Gas Meters			See Notes	.746	.077	.116	
34		Elec.—Electric Meters				.938		.167	
35		G. E.—Total Gas & Electric Costs				.877	.077	.137	.246
36	761–31A	Commercial Collecting Labor Costs (Average per meter)							
37		G. R.—Gas Regular Meters		.473				.076	
38		G. P.—Gas Prepay Meters				See Notes			
39		T. G.—Total Gas Meters	.848	.473	.685	.295		.076	
40		Elec.—Electric Meters		.209	.777			.095	
41		G. E.—Total Gas & Electric Costs	.848	.278	.749		.295	.084	.188
42	761–31B	Commercial Bill Delivery Labor Costs (Average per meter)							
43		G. R.—Gas Regular Meters	See Notes	See Notes	See Notes	See Notes		.056	
44		G. P.—Gas Prepay Meters							
45		T. G.—Total Gas Meters					.086		
46		Elec.—Electric Meters						.052	
47		G. E.—Total Gas & Elec. Costs					.086	.054	.067
48	761–32A	Meter Reading Labor Costs (Average per meter)							
49		G. R.—Gas Regular Meters		.542				.208	
50		G. P.—Gas Prepay Meters							
51		T. G.—Total Gas Meters	.327	.542	.247	.363	.308	.208	
52		Elec.—Electric Meters		.483	.219	.371		.242	
53		G. E.—Total Gas & Electric Costs (Average per meter)	.327	.498	.227	.369	.308	.222	.243
54	761–4	Commercial Supplies and Expense Costs (Average per meter)							
55		Regular Gas Meters—Office Items G. R.—A		1.042				.126	
56		" " " —Meter Reading G. R.—B		.212				.061	
57		" " " —Bill Delivery G. R.—C		See Notes				.046	
58		" " " —Collecting G. R.—D						.059	
59		" " " —Total G. R.—E	See Notes	1.254				.292	

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COST DATA ON CUSTOMERS' ACCOUNTING—Continued

Companies' Reference Code Numbers

Line No.	Question-naire No.	ITEMS		67	68	69	70	71	72	73
60		Prepay Gas Meters—Office Costs	G. P.—A							
61		" " " —Meter Reading	G. P.—B							
62		" " " —Bill Delivery	G. P.—C							
63		" " " —Collecting	G. P.—D							
64		" " " —Total	G. P.—E							
65		Total Gas Meters—Office	T. G.—A		1.042			.246	.126	
66		" " " —Meter Reading	T. G.—B		.212			.018	.061	
67		" " " —Bill Delivery	T. G.—C					.008	.046	
68		" " " —Collecting	T. G.—D					.108	.059	
69		" " " —Total	T. G.—E	.098	.125	.070		.283	.292	
70		Merchandise Accts.—Office	Mdse.—A		.116				.001	
71		" " —Meter Reading	Mdse.—B							
72		" " —Bill Delivery	Mdse.—C							
73		" " —Collecting	Mdse.—D							
74		" " —Total	Mdse.—E		.116				.001	
75		Gas Meter & Mdse. Accts.—Office Costs	G. M.—A		1.488				.127	
76		" " " " —Meter Reading	G. M.—B		.212				.061	
77		" " " " —Bill Delivery	G. M.—C						.046	
78		" " " " —Collecting	G. M.—D						.060	
79		" " " " —Total	G. M.—E		1.70		.215		.295	
80		Electric Meters—Office	Elec.—A		1.323				.171	
81		" " —Meter Reading	Elec.—B		.352				.075	
82		" " —Bill Delivery	Elec.—C						.037	
83		" " —Collecting	Elec.—D						.052	
84		" " —Total	Elec.—E		1.675	.133	.328		.335	
85		Gas & Electric Meters—Office	G.& E. —A		1.250				.145	
86		" " " —Meter Reading	G. & E.—B		.315				.067	
87		" " " —Bill Delivery	G. & E.—C						.042	
89		" " " —Collecting	G. & E.—D						.056	
89		" " " —Total	G. & E.—E		1.565				.310	
90		Gas & Elec. Meters & Mdse.—Office	G. E. M.—A		1.366				.146	.137
91		" " " " —Meter Reading	G. E. M.—B		.315				.067	.021
92		" " " " —Bill Delivery	G. E. M.—C						.042	.007
93		" " " " —Collecting	G. E. M.—D						.056	.080
94		" " " " —Total	G. E. M.—E		1.681	.114	.292		.311	.244
95	614	Merchandise and Jobbing Costs	(Per $ of Sales)							
96		A X—Order Writing—Labor Costs	"					.028	.005	
97		A Y— " " —Supplies and Expenses	"					.004	.001	
98		A Z— " " —Total Expenses	"					.032	.005	
99		B X—Billing and Posting—Labor Costs	"					.038	.020	
100		B Y— " " —Supplies and Expenses	"					.007	.001	
101		B Z— " " —Total	"					.004	.021	
102		C X—Collecting—Labor Costs	"			See Notes		.054	.008	
103		C Y— " —Supplies and Expenses	"					.004		
104		C Z— " —Total	"					.058	.008	
105		D X—Total—Labor Costs	"					.119	.032	
106		D Y— " —Supplies and Expenses	"					.014	.002	
107		D Z— " —Total	"					.133	.034	
		Summary Labor Costs (All meters G & E)								
108		Line 23 Commercial General Labor		2.231	2.23			.696	.470	172
109		Line 29 " Bookkeeping Labor		1.248	1.248		1.002	.245	.573	.404
110		Line 35 " Contract Labor		——			.877	.077	.137	.246
111		Line 41 " Collecting Labor		.278	.278	.749		.295	.084	.188
112		Line 47 " Bill Delivery Labor						.086	.054	.067
113		Line 53 " Meter Reading Labor		.498	.498	.227	.369	.308	.222	.243
114		Total " Labor		4.255	4.26	.976	2.248	1.708	1.540	1.32
115		Total " Supplies and Expenses		1.681		.114	.292	.283	.311	.244
116		Total " Costs		5.936	4.26	1.090	2.540	1.991	1.851	1.564
117		Merchandising and Jobbing Total Cost per meter		——	——	——	——	.133	.034	——
118		Grand Total Cost per meter		5.936	4.26	1.090	2.540	2.124	1.885	1.564

Time-Recording Stamp (Clock), Addressograph Bill Extension Machine.

No. 72 Co.—

Q. 9—

Meters read and bills delivered by same men but in two operations. Collections made by separate crew.

Q. 11—

Defiance Bill Stampers.

No. 73 Co.—

Q. 9—

Three separate forces; reading and bill delivery are under one superintendent and collection and credit under another.

Q. 11—

Burrough's subtracting machines.

Q. 614—

No separate record kept for this division as order writing included in selling expenses.

REPORT OF SUB-COMMITTEE ON BOOKKEEPING WITHOUT BOOKS

W. H. Cassell, *Chairman,* Baltimore, Md.

The Sub-Committee on Bookkeeping Without Books met in Baltimore on Wednesday, April 25th, those present being W. H. Cassell, Chairman, T. R. Clayton, H. Frey, A. R. Keller, and W. A. Doering, Chairman of the Committee on Customers' Accounting.

After a general discussion of the duties of the Committee as outlined in the minutes of the meeting of the General Committee held in New York on December 20th, it was decided to send a brief questionnaire to the companies known to the Committee to have adopted some form of Bookkeeping Without Books. No attempt was made to secure any information as to "actual saving affected as compared with system formerly in use," but inquiry was made as to: (a) Difficulties, if any, experienced in its introduction or operation; (b) Any modifications introduced in the original system as it is applied in Baltimore because of such difficulties, or to take care of special local conditions. Letters were sent to the following companies:

Allentown-Bethlehem Gas Co., Allentown, Pa.

United Gas Improvement Co., (Philadelphia Gas Works) Philadelphia, Pa.

Nashville Gas & Heating Co., Nashville, Tenn.

Consumers Gas Co., Reading, Pa.

Harrisburg Gas Co., Harrisburg, Pa.

Counties Gas & Electric Co., Norristown, Pa.

Public Service Co. of Northern Illinois, Chicago, Ill.

The Philadelphia Co., Pittsburg, Pa.

To date of this report replies have been received from

Rochester Gas & Electric Corporation, Rochester, N. Y.

Northern States Power Co., Faribault, Minn.

United Gas Improvement Co., Philadelphia, Pa.

Harrisburg Gas Co., Harrisburg, Pa.

Counties Gas & Electric Co., Norristown, Pa.

Philadelphia Co., Pittsburg, Pa.

Public Service Co. of Northern Illinois, Chicago, Ill.

Consumers Gas Co., Reading, Pa.

Nashville Gas & Heating Co., Nashville, Tenn.

These replies indicate that all of the companies who have adopted Bookkeeping Without Books follow the basic principle of the Baltimore System, although most of them make some minor changes to suit their local conditions or their own convenience. The following quotation under the heading "Difficulties, if any, experienced in its introduction or operation" are listed as a matter of record.

United Gas Improvement Company

"In general, we are thoroughly satisfied as well as gratified at the success at-

tained through the change, and the proof of our firm belief in this system is the fact that we are going over to it just as rapidly as conditions warrant, meaning by that, at the expiration of the bound ledgers."

Harrisburg Gas Company

"Personally I feel as far as we have gone, that the new system offers more advantages than disadvantages over the old bound books. We realize that it will take a little time to round off the rough corners, but those who are handling the work are very favorably impressed with its possibilities. We are not hurrying the change—rather familiarizing ourselves thoroughly with each step taken, and where the system is carefully followed as far as local conditions will permit, I am satisfied that objections will be eliminated as we proceed with the work."

Counties Gas & Electric Company

"In answer to question 'B', would say that we have not experienced any difficulty in the introduction of the system, and we believe that it is going to work out advantageously. As stated in your letter, we, of course, could not expect to affect any savings as yet. It is considerable work and also some expense in making the change."

Philadelphia Company

"Decidedly difficult to train old employees to see the new system, being so different from the old. The radical change in disposing of ledgers which contained all the data relative to the consumers' account to the new method under which various data is now confined to the Meter Reading Book and other records which makes the delinquent customer more difficult to handle, causing more time in obtaining all information on that class of consumers. In this respect we are making constant changes of minor character to better the detail conditions, and are gradually getting results which in time we expect to come to the point of satisfaction."

Nashville Gas & Heating Company

"Referring to the actual savings effected as compared with the system formerly used, we will be able to reduce the cost of operating our Accounting Department about $5,000 this year. Although we began to change the system January 1st, we did not complete the change until April, so therefore, we feel that after this year our saving will be considerably more than the amount mentioned. We are going to say that we have practically eliminated the difficulties arising from the system. Anyway, much more so than were had with the old system."

The following is a tabulation of the modifications introduced by the various companies:

	Substitute for Ledger			*Cash Posting*		*Filing*	
	Sales Register	Coupon detached from bill	Maintain card record a duplicate of meter book	Daily	Accumulate to due date	Current and Separate	Delinquent together
Rochester Gas & Elec. Corp.	Yes		Yes	Yes			
Northern States Power Co.		Yes	No	Yes		Yes	
United Gas Improvement Co.		Yes	No		Yes	Yes	
Harrisburg Gas Co.		Yes	No		Yes		
Counties Gas & Elec. Co.		Yes	No	Yes			Yes
Philadelphia Company	Yes		No	Yes			Yes
Cons. G. Elec. Lt. & Pr. Co. (Balt.)		Yes	No		Yes	Yes	Yes
Public Service Co. of N. Illinois		Yes	No	Yes			
Consumers Gas Co.		(In use since 1/1/23—well satisfied)					

The following is a summary of this tabulation:

Substitute for Ledger

Coupon detached from bill (Balto. System) 7

Sales Register 1

Cash Posting

Accumulate to due date (Balto. System) 3

Post Daily 6

Filing

Currents separate from delinquents (Balto. System) 3

Currents merged with 4

Maintain a card record — practically a duplicate of the meter reading book (Rochester Gas & Electric Corp.) ... 1

In conclusion, it is the opinion of the writer as Chairman of the Sub-Committee that some method of keeping the Sub-Committee apprised of the companies adopting the Baltimore System will have to be devised, and it is suggested that an article be prepared outlining the fact that such a Committee exists, and explaining its duties together with an appeal to the companies who contemplate adopting or who have adopted the Baltimore System to forward such information to the Committee so that correspondence may be entered into with a view of ascertaining the difficulties, and modifications, if any.

MERCHANDISE ACCOUNTING SYSTEMS

A. R. Keller, Syracuse, N. Y.

Foreword

There is a romance in store for those who will look back over the past few years to see what an evolution modern systems of merchandising accounting have caused in our great gas industry, particularly in the case of those utilities who are pushing the merchandising end in order to increase their gas sales.

A generation ago there were few gas utilities who found it necessary to devote much time to their merchandise accounting, as the sale of appliances during this period has grown from substantially nothing to upward of $100,000,000, necessitating accurate and economical procedures of accounting.

To explain a system that would give the results necesary to successful utility merchandising would necessitate the showing of each operation from the time of purchasing goods for stock, to the time of delivery to customer. This would include the salesroom routine as well as the other departments involved, dealing with the public. No effort has been made in this paper to deal with the above routine, but only with records which involve the customer personally, a relation which is most important in a public utility.

Generally speaking, the system should be of such a nature that the elapsed time on a normal order between the giving of the order by the customer to the order department and the receiving of same by the dispatching department should not exceed one hour. The system should also be devised to reduce delay on an abnormal order to a minimum, such as the passing of credit, etc. Collections should be closely followed as nothing agitates a customer more readily than to have the collection of an account lag for two or three months particularly where collectors are employed and appliances are purchased on time payments. Close supervision of this one point will eliminate a great deal of annoyance to the customer as well as the utility. This necessitates well trained, courteous and neat appearing collectors.

A modern gas utility has not only to sell its merchandise at a fair profit but its service and good will as well, hence it is of the utmost importance that bills be rendered regularly, accurately and promptly and in such a manner that it is easily understood by the customer. Bearing this in mind the Committee on Merchandise Accounting decided that the best way to get before the members of our Association, information that would be of value to them, was to select a group of companies using modern systems; not presenting them as ideal, nor the last word in merchandise accounting, but with the thought in mind of bringing out the important points in this paper. An appendix is attached

giving the complete description of such systems, any of which could be adapted to the needs or requirements of member companies.

Important Features of the Merchandise Accounting System of The Peoples Gas Light & Coke Co., Chicago, Ill.

1. Multiple ticket system permits of prompt despatching of orders to executing and accounting departments.
2. Accuracy is assured by receiving copy of original order issued.
3. Billing installments on gas bills assure prompt payments.
4. Control system proves all orders received are entered and properly billed.
5. Individual ledger balances can be had at any time during month.
6. System can be operated at a low cost per item.

This company operates its system on bookkeeping machines and it is particularly adaptable to large companies.

Boston & Rochester

The advantages in favor of the Boston and Rochester systems are as follows:

1. Making of both ledger card and invoice at one writing.
2. Assurance that these both agree as they are written at the same time.
3. Assurance that all items are put on the ledger and invoice.
4. Proof of correct addition of every charge ticket and that no items have been omitted.
5. No congestion of work at the end of the month—each day's work is completed on that day.
6. Trial balance figures at the close of business every night.

These companies operate their systems on bookkeeping machines but they could readily be adapted by companies desiring to use typewriters.

The system in use at Rochester will be shown in operation at the Accounting Section Exhibit, Booths Nos. 189, 190, 199 and 200, and advantages as shown above will be clearly demonstrated.

Allentown

The advantages in favor of the Allentown system are as follows:

1. Adaptable to any number of accounts to be handled daily, such as the peak load of a special campaign.
2. Uniform distribution of work from day to day.
3. Minimum amount of labor and material.
4. Bills are in purchasers' hands two days after completion of order, which in turn invites early settlement.
5. The method of routing convenient to placing amounts on gas bills.
6. Consumers' invoice and ledger sheet identical as one is a carbon copy of the other.
7. The amount of the bill is the same as the amount of the signed sales order as these are checked by the spreader sheet.
8. Elimination of errors due to no transcribing from one form to another.
9. The original sales order (never transcribed) bearing signature when order is placed, and again when material is installed by fitter, shows all dates and all information placed thereon, during the process of installation, is the merchandise clerk's ready reference to intelligently discuss anything with the purchaser.

This company operates its system on the typewriter, but it could well be adapted by a large as well as a small company.

DESCRIPTION OF MERCHANDISE ACCOUNTING SYSTEM OF THE PEOPLES GAS LIGHT AND COKE COMPANY, CHICAGO, ILL.

Merchandise Contract

The Salesperson issues orders in quadruplicate. Copies No. 1 and No. 2 are sent to the Application Department. Copy No. 3 is sent by cashier to the Cash Writing Department where the first payment is entered on the cash sheet, and the copy is then sent to the Bookkeeping Department; copy No. 4 is the customer's receipt and copy of contract. (See Exhibit "A".)

The Bookkeeping Department forwards ticket No. 3 to the Correspondence Department where an appliance ledger sheet is typed; this shows customer's name, address, floor, style of appliance, price, amount of first payment, and number and amount of installments. This ticket and sheet are held in pending file in the Bookkeeping Department until the "Set" ticket is received. (See Exhibit "B".)

Merchandise Order Tickets

Copy No. 2, (Exhibit C)) issued by salesperson is used by the Application Department as a copy for issuing the necessary tickets to all departments concerned in the transaction.

This necessitates ten copies of each order being made and the set is bound into book form. This is accomplished by typing one copy. The others are obtained by the use of a "Ditto" machine. The whole is then sent to the Central Storehouse and the original ticket (No. 1) is sent to the Central Bureau. (See Exhibit "C.")

The top cover is separated at the Storehouse and held until delivery is made. The first small white memo slip is detached at the Storehouse and sent to the Application Department Pending File, showing that the appliance is out for delivery. The other small white slip is kept by delivery man to report reason why appliance cannot be delivered.

Delivery ticket No. 2 (Exhibit C). When the appliance has been delivered, this ticket is sent to the Stores Accounting Department to credit stock and material used by Storehouse.

Stores ticket No. 3 is held at the Storehouse for permanent record. Tickets No. 4, 5, and cover are forwarded to the shop. After the Appliance has been connected, ticket No. 4 is returned with the cover to the Control Bureau showing that the order has been completed. Then work ticket No. 4 is sent to the Stores Accounting Department to credit labor and material used by Shop.

Ticket No. 5 is filed at Shop as a permanent record.

After appliance has been delivered, ticket No. 6 is sent to Consumer's Bookkeeping Department and from these tickets the Life Book records are made (in sheet form). Tickets are then sent to Bookkeeper who enters contract number on gas ledger opposite customer's

MERCHANDISE CONTRACT ADDRESS____________ FLOOR______

PHONE______ EXCHANGE______ NAME______

KEY AND INSTRUCTIONS AT______

SALESMAN Indicate Present Condition by Words, "In" or "Ordered"

SERVICE______ METER______ JOBBING______

PEOPLES GAS STORES, INC., (hereinafter referred to as the Peoples Gas Stores)—
Please deliver to my address as shown above, the following merchandise:

Have other appliances or fixtures been ordered______

QUANTITY	PRICE	DESCRIPTION	PRICE	

For which I agree to pay the sum of______ Dollars ($______) on the following terms:______ Dollars on the signing of this agreement and______ Dollars each and every month thereafter for______ months until the said amount has been fully paid.

Until the said equipment has been fully paid for it is to remain the sole property of the Peoples Gas Stores with full title, ownership and right of possession resting in it. The subscriber agrees to keep said equipment at all times in good condition and repair and to indemnify the Peoples Gas Stores from all damage to said equipment and also from all damage to persons and property resulting from the installation and use of said equipment. In the event of non-payment of any of said installments at the time above specified, or of the sale, encumbrance or removal of said equipment from subscriber's said address without written consent of the Peoples Gas Stores, the Peoples Gas Stores shall have the right to declare all said sum then remaining unpaid to be due and payable at once, and immediately retake possession of said equipment wheresoever situated, and shall be entitled to retain as rental, for the time the subscriber has had said equipment, all payments theretofore made by the subscriber under this agreement.

This agreement is subject to the approval of the Credit Department of the Peoples Gas Stores, and shall not be binding on it until endorsed with such approval.

Glassware and mantles are not guaranteed. Free fuel runs of piping for domestic appliances limited to twenty-five (25) feet.

Received first payment $______

PEOPLES GAS STORES, INC.,

By______ Salesman; No.______

Location of Store or Agent______

CHICAGO,______ 19____

Subscriber______

FORM 1711 (OVER) 1

MERCHANDISE CONTRACT DATA SLIP

ACCOUNT NO.______ ADDRESS______ FLOOR______

PHONE______ EXCHANGE______ NAME______

KEY AND INSTRUCTIONS AT______

SALESMAN—Indicate Present Condition by Words, "In" or "Ordered".

SERVICE______ METER______ JOBBING______

LEDGER______ PAGE______ FOLIO______

Have other appliances or fixtures been ordered______

ORDER:______

For which I agree to pay the sum of______ Dollars ($______) on the following terms:______ Dollars on the signing of this agreement and______ Dollars each and every month thereafter for______ months until the said amount has been fully paid.

REPORT:______

House No. and Floor Supplied | Appliance connected to Meter No.______ Size____ Index______ Location______

Checked______ | Style of Appliance______ Date Completed______ 19____ ______ Fitter.

PEOPLES GAS STORES, INC.

By______ Salesman; No.______

Location of Store or Agent______

CHICAGO,______ 19____

Subscriber______

FORM 1711-A 2

Exhibit A—Actual Size 8" x 5"

Reverse side of ticket No. 1 used for instructions to sales people.
Reverse side of ticket No. 2 used for recapitulation of material used.

MERCHANDISE CONTRACT

ADDRESS ______________________ FLOOR ______

PHONE __________ EXCHANGE __________ NAME __________________

KEY AND INSTRUCTIONS AT ______________________

SALESMAN—Indicate Present Condition by Words, "In" or "Ordered".

SERVICE ________ METER ________ JOBBING ________

PEOPLES GAS STORES, INC. (hereinafter referred to as the Peoples Gas Stores)—
Please deliver to my address as shown above, the following merchandise:

Have other appliances or fixtures been ordered ______________

QUANTITY	PRICE	STORES ITEM NO.	DESCRIPTION	PRICE

For which I agree to pay the sum of ______________ Dollars ($ ________) on the following terms: ______________ Dollars on the signing of this agreement and ______________ Dollars each and every month thereafter for ________ months until the said amount has been fully paid.

SEND THIS TICKET WITH
NO. 1 AND 2 TO MAIN OFFICE
WITH FIRST PAYMENT

3

FORM 1711-B

MERCHANDISE CONTRACT

ADDRESS ______________________ FLOOR ______

PHONE __________ EXCHANGE __________ NAME __________________

KEY AND INSTRUCTIONS AT ______________________

SALESMAN Indicate Present Condition by Words, "In" or "Ordered"

SERVICE ________ METER ________ JOBBING ________

PEOPLES GAS STORES, INC., (hereinafter referred to as the Peoples Gas Stores)—
Please deliver to my address as shown above, the following merchandise:

Have other appliances or fixtures been ordered ______________

QUANTITY	PRICE	DESCRIPTION	PRICE

For which I agree to pay the sum of ______________ Dollars ($ ________) on the following terms: ______________ Dollars on the signing of this agreement and ______________ Dollars each and every month thereafter for ________ months until the said amount has been fully paid.

Until the said equipment has been fully paid for it is to remain the sole property of the Peoples Gas Stores with full title, ownership and right of possession resting in it. The subscriber agrees to keep said equipment at all times in good condition and repair and to indemnify the Peoples Gas Stores from all damage to said equipment and also from all damage to persons and property resulting from the installation and use of said equipment. In the event of non-payment of any of said installments at the time above specified, or of the sale, encumbrance or removal of said equipment from subscriber's said address without written consent of the Peoples Gas Stores, the Peoples Gas Stores shall have the right to declare all said sum then remaining unpaid to be due and payable at once, and immediately retake possession of said equipment wheresoever situated, and shall be entitled to retain as rental, for the time the subscriber has had said equipment, all payments theretofore made by the subscriber under this agreement.

This agreement is subject to the approval of the Credit Department of the Peoples Gas Stores, and shall not be binding on it until endorsed with such approval.

Glassware and mantles are not guaranteed. Free fuel runs of piping for domestic appliances limited to twenty-five (25) feet.

Received first payment $ ________

PEOPLES GAS STORES, INC.,

By ______________ Salesman; No. ______

Location of Store or Agent ______________

4

CHICAGO, ______________ 19____

Subscriber ______________

(OVER)

FORM 1711-C

Exhibit A—Actual Size 8" x 5"

APPLIANCE LEASE RECORD

LEASE NO.______________________ SERIAL NO.______________________

NUMBER	STREET	FLOOR	NAME	GAS LEDGER	PAGE	FOLIO

STYLE OF APPLIANCE

PRICE	1ST PAYMENT	NO. INSTALLMENTS	RATE	DATE OF		
				1ST PAYMENT	SET	REMOVAL

NO.	INSTALL-MENT	DATE PAID	BALANCE DUE	NO.	INSTALL-MENT	DATE PAID	BALANCE DUE	NO.	INSTALL-MENT	DATE PAID	BALANCE DUE
1				8				15			
2				9				16			
3				10				17			
4				11				18			
5				12				19			
6				13				20			
7				14				21			

REMARKS

THE PEOPLES GAS LIGHT & COKE CO.
FORM 407 CHICAGO.

Exhibit B—Actual Size 8½" x 7"

MERCHANDISE ORDER — PEOPLES GAS STORES — FORM 1735-1
MASTER COPY — DATE OF CONTRACT
CONTROL TICKET 1 — LEASE NUMBER

DELIVER AT
PURCHASER:
TELEPHONE:
KEY AND INSTRUCTIONS:
ACCOUNT NO: STORES ITEM NO.
APPLIANCE:
PRICE: $ TERMS: INST:
SEND BILL TO
PURCHASER'S ORDER NO.:
SOLD BY:

SHOP DIVISION — NORTH, SOUTH, WEST
SERVICE — IN OR ORDERED
METER — IN OR ORDERED
JOBBING — YES OR NO
DELIVER — CENTRAL STORES, MANUFACTURER
CONNECT — SHOP M'F'R OR PLUMBER
OTHER APPLIANCES ORDERED
PROSPECT

TYPED BY: CHECKED BY: DUPLICATED BY:

FOLLOW-UP REPORTS

DISPATCH CONTROL TICKET TO CONTROL BUREAU

MERCHANDISE ORDER — PEOPLES GAS STORES — FORM 1735-2
DATE OF CONTRACT
DELIVERY TICKET 2 — LEASE NUMBER

DELIVER AT:
PURCHASER:
TELEPHONE:
KEY AND INSTRUCTIONS.
ACCOUNT NO: STORES ITEM NO.
APPLIANCE:
PRICE: $ TERMS: INST:
SEND BILL TO
PURCHASER'S ORDER NO.:
SOLD BY:

SHOP DIVISION — NORTH, SOUTH, WEST
ADDRESS VERIFIED
SERVICE — IN OR ORDERED
METER — IN OR ORDERED
JOBBING — YES OR NO
DELIVER — CENTRAL STORES, MANUFACTURER
CONNECT — SHOP M'F'R OR PLUMBER
OTHER APPLIANCES ORDERED
PROSPECT

REPORT WHYNOTS ON ABOVE ATTACHED MEMORANDUM BLANK
METER NO. SIZE

Received above appliance and material listed below:
Date:
Signed by:
Delivered by:

This certifies that above appliance has been equipped with all loose parts, connected to my entire satisfaction and necessary instructions given:
Date:
Signed by:

APPLIANCES TO BE DELIVERED ON THIS TICKET ONLY

VERIFY HOUSE NUMBER, STREET AND FLOOR. PLACE CHECK MARK OPPOSITE "ADDRESS VERIFIED"

STORES STOCK		
FITTINGS	SIZE	NO
FLUE PIPE JOINTS		
TAPER JOINTS		
FLUE REDUCERS		
ELBOWS		
TEES		
ELL. TEES		
COLLARS		
AIR SHIELDS		
W.I. PIPE		
" "		
" "		

THIS TICKET TO BE FILED IN STORES ACCTG. DEPT.

FOR MFR. DELIVER ORDERS
TO BE FILLED IN BY GENERAL OFFICE DEPTS. ONLY.

ITEM	APPLIANCE	INSTALLATION	ACCESSORIES
PURCHASE ORDER NO			
NOTIFICATION DATE			
COMPLETION DATE			
INVOICE CHECKED BY			
INVOICE VALUE			
OTHER CHARGES			
TOTAL VALUE			
LISTED IN STORES ACCTG DEPT BY		COST OF MERCHANDISE	

REMARKS:

MERCHANDISE ORDER — PEOPLES GAS STORES — FORM 1735-3
DATE OF CONTRACT
STORES TICKET 3 — LEASE NUMBER

DELIVER AT
PURCHASER:
TELEPHONE:
KEY AND INSTRUCTIONS:
ACCOUNT NO: STORES ITEM NO.
APPLIANCE:
PRICE: $ TERMS: INST:
SEND BILL TO
PURCHASER'S ORDER NO.:
SOLD BY:

SHOP DIVISION — NORTH, SOUTH, WEST
SERVICE — IN OR ORDERED
METER — IN OR ORDERED
JOBBING — YES OR NO
DELIVER — CENTRAL STORES, MANUFACTURER
CONNECT — SHOP M'F'R OR PLUMBER
OTHER APPLIANCES ORDERED
PROSPECT

METER NO. SIZE

Received above appliance and material listed below:
Date:
Signed by:
Delivered by:

This certifies that above appliance has been equipped with all loose parts, connected to my entire satisfaction and necessary instructions given:
Date:
Signed by:

APPLIANCES TO BE DELIVERED ON DELIVERY TICKET ONLY

STORES STOCK		
FITTINGS	SIZE	NO
FLUE PIPE JOINTS		
TAPER JOINTS		
FLUE REDUCERS		
ELBOWS		
TEES		
ELL. TEES		
COLLARS		
AIR SHIELDS		
W.I. PIPE		
" "		
" "		

THIS TICKET TO BE FILED IN STORES DEPARTMENT

FOR MFR. DELIVER ORDERS
TO BE FILLED IN BY GENERAL OFFICE DEPTS. ONLY

ITEM	APPLIANCE	INSTALLATION	ACCESSORIES
PURCHASE ORDER NO			
NOTIFICATION DATE			
COMPLETION DATE			
INVOICE CHECKED BY			
INVOICE VALUE			
OTHER CHARGES			
TOTAL VALUE			
LISTED IN STORES ACCTG DEPT BY		COST OF MERCHANDISE	

REMARKS:

MERCHANDISE ORDER — PEOPLES GAS STORES — FORM 1735-4
DATE OF CONTRACT
WORK TICKET 4 — LEASE NUMBER

DELIVER AT
PURCHASER
TELEPHONE
KEY AND INSTRUCTIONS:
ACCOUNT NO Y STORES ITEM NO
APPLIANCE 61
PRICE: $ TERMS INST
SEND BILL TO
PURCHASER'S ORDER NO.:
SOLD BY

SHOP DIVISION — NORTH, SOUTH, WEST
SERVICE — IN OR ORDERED
METER — IN OR ORDERED
JOBBING — YES OR NO
DELIVER — CENTRAL STORES, MANUFACTURER
CONNECT — SHOP M'F'R OR PLUMBER
OTHER APPLIANCES ORDERED
PROSPECT

REPORT WHYNOTS ON ABOVE ATTACHED MEMORANDUM BLANK
METER NO. SIZE

Received above appliance and material listed below:
Date:
Signed by:
Delivered by:

This certifies that above appliance has been equipped with all loose parts, connected to my entire satisfaction and necessary instructions given:
Date
Signed by

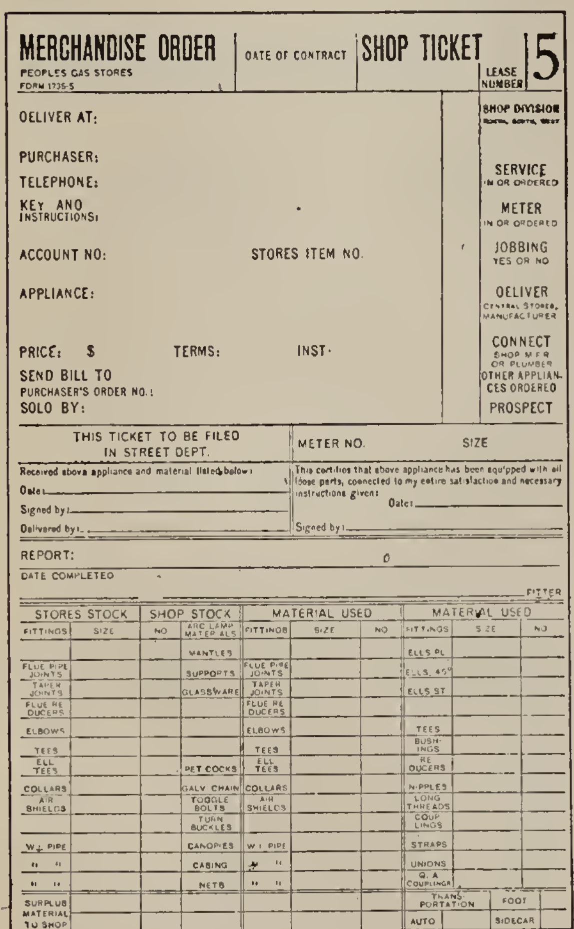
REPORT
DATE COMPLETED
FITTER

STORES STOCK			SHOP STOCK	MATERIAL USED			MATERIAL USED		
FITTINGS	SIZE	NO	ARC LAMP MATERIALS	FITTINGS	SIZE	NO	FITTINGS	SIZE	NO
			MANTLES				ELLS PL		
FLUE PIPE JOINTS			SUPPORTS	FLUE PIPE JOINTS			ELLS, 45°		
TAPER JOINTS			GLASSWARE	TAPER JOINTS			ELLS ST		
FLUE REDUCERS				FLUE REDUCERS					
ELBOWS				ELBOWS			TEES		
TEES				TEES			BUSHINGS		
ELL. TEES			PET COCKS	ELL. TEES			REDUCERS		
COLLARS			GALV. CHAIN	COLLARS			NIPPLES		
AIR SHIELDS			TOGGLE BOLTS	AIR SHIELDS			LONG THREADS		
			TURN BUCKLES				COUPLINGS		
W.I. PIPE			CANOPIES	W.I. PIPE			STREETS		
" "			GASKETS	" "			UNIONS		
" "			NUTS	" "			R. & L. COUPLINGS		
SURPLUS MATERIAL TO SHOP							TRANSPORTATION	FOOT	
							AUTO	SIDECAR	

Exhibit C—Actual size of ticket 8″ x 5″

name; shows ledger number, page and folio on ticket and returns to the Control Clerk, in the Appliance Division of the Bookkeeping Department. He enters ledger, page and folio on appliance lease record sheets, and life sheets, debits individual ledger with amount of the sale, and forwards appliance lease record of these amounts must agree with the total sales on the Life Book sheets.

Once a month each bookkeeper reports to the Control Clerk the amount of cash received, allowances made, and the present outstandings as shown by his ledger accounts. (See Exhibit "D.")



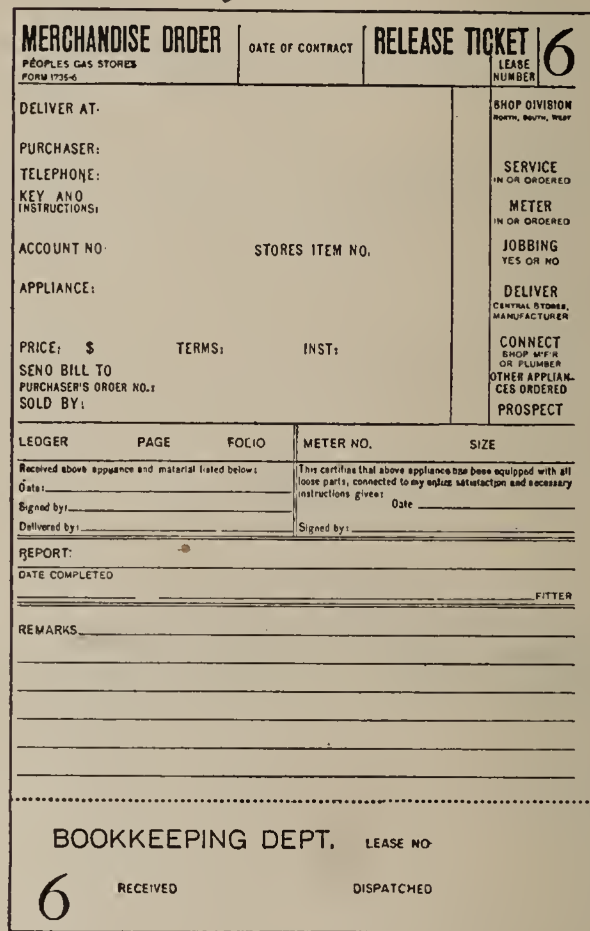


Exhibit C

sheet to the bookkeeper to be filed in appliance binder.

The coupons on the back of each book carry the order number. As each operation is completed the coupons are detached and sent to the Control Bureau, making it possible for them to tell the status of each order daily.

Merchandise Control Sheet

All sales are debited to individual ledgers daily on the control sheets. The totals

Billing Deferred Merchandise Payments

Monthly installments are added to gas bills from Appliance Lease Record. When paid, the amounts are posted in spaces provided. (See Exhibit "B.")

When appliance installments are not paid, they are drawn off on collection books.

Charge Orders

Charge Orders are issued, instead of Merchandise Contracts when a customer

purchases merchandise and requests that a bill be rendered to him for the full amount to be paid within 30 days.

These accounts are carried on a separate loose leaf ledger and separate bills are rendered. (See Exhibit "E.")

Out of town customers.

Trial installations by Industrial Department.

Accounts that are carried in Suspense Ledger are billed monthly on commercial bills, with the exception of "cut off accounts." If payments become delinquent, the Collection Department is notified by means of a locate ticket.

FORM [illegible]
THE PEOPLES GAS LIGHT & COKE CO
CHICAGO

CONTROL SHEET

LEDGER__________

MONTH__________

	OLD BALANCE	DATE	PAGE	FOLIO	LINE	SALES	CREDITS	PRESENT BALANCE	1ST PAYMENTS			
									OLD BALANCE	AMOUNT	PRESENT BALANCE	

Exhibit D—Actual Size 11" x 11"

Suspense Accounts

The following classes of accounts are held in "Suspense."

Gas cut off, and new address unknown.

No gas accounts.

The accounts described above are all part of the control explained previously

☐ CHARGE or ☐ C.O.D. SALE TICKET

DELIVER AT

NEAR APT.

PURCHASER

TELEPHONE

KEY AND INSTRUCTIONS

CONTRACT NUMBER | PURCHASE ORDER NO. | COMMISSION YES / NO

MAIL BILL TO

SHOP — DIVISION
NORTH SOUTH WEST

SERVICE
IN OR ORDERED

METER
IN OR ORDERED

JOBBING
IN OR ORDERED

DELIVER
CENTRAL STORES, MANUFACTURER

CONNECT
SHOP, MFR OR PLUMBER

OTHER APPLIANCES ORDERED

PROSPECT

SECTION	SALESPERSON	AM'T OF SALE	DEPOSIT	DAY	MO.	YEAR

QUANTITY	ARTICLES	STORES ITEM NO.	UNIT PRICE	AMOUNT

CREDIT APPROVAL STAMP

455- 5

DO NOT DESTROY, ALTER OR HOLD OVER A CHECK

SECTION	SALESPERSON	AM'T OF SALE	DEPOSIT	DAY	MO.	YEAR

CREDIT APPROVAL STAMP

STORES ACCOUNTING DEPARTMENT VOUCHER

455- 5

Form 1711

Exhibit E—Actual Size 5" x 8"

Reverse side of ticket used for credit information.

LOCATE ORDER

ADDRESS FLOOR DATE 191

ISSUED BY NAME LEDGER PAGE FOLIO

NEW ADDRESS	STOVE LEASE NO. CO'S NO.
CAUSE OF CUT OFF	LIGHT APPLIANCE LEASE NO.
DATE OFF DATE LAST PAYMENT	RENTAL LAMPS LEASE NO. DATE OF CONTRACT
TOTAL AMOUNT PAID $	MAINTAINED LAMPS LEASE NO. DATE OF CONTRACT
NO. INSTALLMENTS UNPAID @ $	SMALL LIGHT MAINT. LEASE NO. DATE OF CONTRACT
NO. INSTALLMENTS PAST DUE @ $	LAMP INSTALLMENT LEASE NO.

REMARKS

DATE TO COLL. DEPT. DATE TO COMM'L DEPT LINE NO. CREDIT $

REPORT APPLIANCE LOCATED CHARGE ON BILL AT FLOOR

DATE LOCATED 191 NAME

APPLIANCE CONNECTED LEDGER PAGE FOLIO

REMARKS

COLLECTOR

THE PEOPLES GAS LIGHT & COKE CO.
CHICAGO

FORM 175

DATE FROM COLLECTION DEPT.

ACCT. TRANSFERRED DEBIT, $

Exhibit F—Actual Size 8" x 5"

and are included in the general merchandise balance sent to the General Accounting Department.

Locate Orders

When an account is cut off for a customer who is paying for an appliance on the deferred payment plan, a locate order (See Exhibit "F") is issued and attached to the leased appliance record sheet. These accounts are separated into two classes, viz., those with new addresses and those without new addresses.

"Locates" that do not show where customers have moved to are sent to the Collection Department to locate customers. The corresponding ledger sheets are then charged to and placed in a "Suspense Ledger."

"Locates" with new addresses are sent to the bookkeepers who have such addresses and, if customers are found to be using gas, the ledger, page, and folio is entered on tickets and these are returned to the appliance control clerk. The new ledger, page and folio is entered on the appliance ledger sheet; the amount outstanding is charged on control sheet to new ledger; the ledger sheets are sent to bookkeepers to file in appliance ledger binders.

"Locates" completed by Collection Department are forwarded to the Bookkeeping Department where ledger sheets are removed from the Suspense Ledger and sent to bookkeepers having the new addresses which have been supplied by collectors.

Merchandise Remove Tickets

Remove tickets are made out from "Request for Removal" (See Exhibit "G") issued by the "Sales Department" and from "Locates" issued by Collection Department. They are made out in books of six tickets and follow practically the

REQUEST FOR REMOVAL DATE 192 MERCHANDISE REMOVE ORDER NO.

REMOVE AT:	APPLYING ON	SECTION	STORE MANAGER
NAME:	CASH SALE		
ADDRESS BILLED AT: TEL.	CHARGE SALE	THIS REQUEST MUST BE APPROVED BY THE OFFICE OF THE SUPERINTENDENT OF SALES BEFORE MERCHANDISE REMOVE ORDER IS ISSUED.	
INSTRUCTIONS:	CONTRACT	APPROVED	
ACCOUNT NO.:	REMOVE CENTRAL STORES MANUFACTURER		

QUANTITY	COMPLETE DESCRIPTION OF ARTICLE	STORES ITEM NUMBER	AMOUNT OF SALE	REASON FOR RETURN

SALES CHECK NUMBER:	DATE SOLD:	CONTRACT NUMBER:	NUMBER OF PAYMENTS:	AMOUNT PAID:

SEND REFUND TO: ADDRESS:

REFUND CUSTOMER: $		CREDIT CUSTOMER: $		REFUND CASHIER: $	REFUND CASHIER CARTAGE: $

SALES DEPT. INSTRUCTIONS:

PEOPLES GAS STORES, INC.
FORM 1770 CHICAGO

Exhibit G—Actual Size 8" x 5"

MERCHANDISE ORDER
PEOPLES GAS STORES, INC.
FORM 1770-2

DATE OF REQUEST

REMOVE TICKET ORDER NUMBER **2**

REMOVE AT:

NAME:
ADDRESS
BILLED AT: TEL.:
INSTRUCTIONS:

ACCOUNT NO.: STOCK ACCT. NO.:

REQUEST OR LOCATE

CASH, CHARGE OR CONTRACT

REMOVE
CENTRAL STORES, MANUFACTURER

MATERIAL REMOVED			MATERIAL USED		
FITTINGS	SIZE	NO.	FITTINGS	SIZE	NO.

QUANTITY	COMPLETE DESCRIPTION OF ARTICLE	STORES ITEM NO.	AMOUNT OF SALE

REPORT

SALES CHECK NUMBER DATE SOLD CONTRACT NO.

SEND REFUND TO
ADDRESS

REFUND CUSTOMER $ CREDIT CUSTOMER: $ REFUND CASHIER $ CARTAGE $

SALES DEPT.: INSTRUCTIONS:

APPROVED

DATE REMOVED BY
DATE RECEIVED BY

FOR MFR. REMOVE ORDERS
TO BE FILLED IN BY GENERAL OFFICE DEPTS. ONLY

DATE OF ORDER TO MFR	COST OF MDSE.
INVOICE CHECKED BY	MFR'S CREDIT
LISTED IN STORES ACCTG. DIV. BY	DIFFERENCE

Exhibit H—Actual Size 8" x 5"

Six tickets are made out on this form of which Nos. 2, 3, 4 and 6 are shown.

MERCHANDISE ORDER
PEOPLES GAS STORES, INC.
FORM 1770-3

DATE OF REQUEST

STORES TICKET ORDER NUMBER **3**

REMOVE AT:

NAME:
ADDRESS
BILLED AT: TEL.:
INSTRUCTIONS:

ACCOUNT NO.: STOCK ACCT. NO.:

REQUEST OR LOCATE

CASH, CHARGE OR CONTRACT

REMOVE
CENTRAL STORES MANUFACTURER

MATERIAL REMOVED			MATERIAL USED		
FITTINGS	SIZE	NO.	FITTINGS	SIZE	NO.

QUANTITY	COMPLETE DESCRIPTION OF ARTICLE	STORES ITEM NO.	AMOUNT OF SALE

REPORT

SALES CHECK NUMBER DATE SOLD: CONTRACT NO.:

SEND REFUND TO:
ADDRESS:

REFUND CUSTOMER: $ CREDIT CUSTOMER: $ REFUND CASHIER: $ CARTAGE: $

SALES DEPT.: INSTRUCTIONS:

APPROVED:

DATE REMOVED BY
DATE RECEIVED BY

FOR MFR. REMOVE ORDERS
TO BE FILLED IN BY GENERAL OFFICE DEPTS. ONLY

DATE OF ORDER TO MFR.	COST OF MDSE.
INVOICE CHECKED BY	MFR'S CREDIT
LISTED IN STORES ACCTG. DIV. BY	DIFFERENCE

PRESENT THIS RECEIPT IN CASE OF CLAIM

PEOPLES GAS STORES, INC. **CUSTOMER'S RECEIPT** ORDER NUMBER **4**

FORM 1770-4

REMOVE AT:

NAME:
ADDRESS
BILLED AT: TEL.:
INSTRUCTIONS:

ACCOUNT NO.: STOCK ACCT. NO.:

REQUEST OR LOCATE

CASH, CHARGE OR CONTRACT

REMOVE
CENTRAL STORES, MANUFACTURER

QUANTITY COMPLETE DESCRIPTION OF ARTICLE STORES ITEM NO. AMOUNT OF SALE

SALES CHECK NUMBER DATE SOLD CONTRACT NO.

SEND REFUND TO
ADDRESS

REFUND CUSTOMER $ CREDIT CUSTOMER $ REFUND CASHIER $ CARTAGE $

SALES DEPT. INSTRUCTIONS

APPROVED

Exhibit H—Actual Size 8" x 5"

MERCHANDISE ORDER
PEOPLES GAS STORES, INC.
FORM 1770-6

DATE OF REQUEST

CREDIT TICKET ORDER NUMBER **6**

LEDGER PAGE FOLIO

ENTERED ON LEDGER DATE

AMOUNT OUTSTANDING

REMOVE AT:

NAME:
ADDRESS
BILLED AT: TEL.:
INSTRUCTIONS:

ACCOUNT NO.: STOCK ACCT. NO.:

REQUEST OR LOCATE

CASH, CHARGE OR CONTRACT

REMOVE
CENTRAL STORES, MANUFACTURER

ENTERED IN STORES ACCTG. DIV. BY DATE

QUANTITY COMPLETE DESCRIPTION OF ARTICLE STORES ITEM NO. AMOUNT OF SALE

REPORT:

SALES CHECK NUMBER: DATE SOLD: CONTRACT NO.:

DATE REMOVED BY

DATE RECEIVED BY

SEND REFUND TO:
ADDRESS:

REMARKS:

REFUND CUSTOMER: $ CREDIT CUSTOMER: $ REFUND CASHIER: $ CARTAGE: $

SALES DEPT. INSTRUCTIONS:

APPROVED:

Exhibit H—Actual Size 8" x 5"

same routine as merchandise orders.
(See Exhibit "H.")

Merchandise Cash Receipts, Allowances and Refunds

All deferred payments made are entered on cash sheets of the individual ledgers by the Cash Writing Department (See Exhibit "I"). Bookkeeper posts ledger card from these sheets and uses the total receipts for his daily cash recapitulation.

The daily cash totals of all ledgers are given to the Recapitulation Clerk by the Cash Writing Department and each bookkeeper must balance to these totals.

Allowances are made for two reasons: viz., when appliance is connected by an outside fitter and also when an appliance is paid for in full before expiration of contract.

CASH RECEIPTS

PAGE FOLIO	GAS	ADDITIONAL CHARGE	APPLIANCE	PAGE FOLIO	GAS	ADDITIONAL CHARGE	APPLIANCE

Exhibit I—Actual Size 10⅝" x 15 13/16"

All refunds made on merchandise are sent to Credit Ledger No. 300, either for making a cash refund or applying the money to any outstanding account that the customer may owe.

General Balance Sheet

On the debit side of this balance sheet is shown the amount of sales for the month with the outstanding for the previous months. The credit side shows the cash received, allowances, removes, and present outstandings.

The "Present Outstanding" figure must agree with the total outstanding shown on the combined Control Sheet.

Credits

All merchandise contracts are taken subject to the approval of the Credit Department.

PROCEDURE FOR MERCHANDISE ACCOUNTS AT THE BOSTON CONSOLIDATED GAS CO. BOSTON, MASS.

Orders taken by salesmen are made out on regular order form in quadruplicate. Original A for office file, duplicate B is customer's receipt, triplicate C shop work slip, quadruplicate D shop office copy.

All copies with the exception of customer's copy are turned in by salesmen to Appliance Office where they are rated for credit and given a number. They are then tabulated into the class of sale for quantity sold.

Original copy A remains in Appliance Office until work is completed.

Work slip C and Shop Office copy D is forwarded to shop after having been listed for numbers.

Upon arrival at shop the orders are listed in a registry.

Work slips are separated from office copy. The work slip is charged on registry against the Inspector in charge of the division in which the order may apply. Work office copy is filed alphabetically.

Inspectors turn in at end of each day a "Why Not" report covering all orders for which they have been charged. Notations are made therefrom to the Shop Office copy which shows the progress of the order.

Upon completion of the order, the Work slip is matched with the Office copy. Registry is credited and the work slips are forwarded to the Appliance Office together with a listing of the order numbers. Upon arrival, the office copy of the order is removed from Office file, the order is then turned over to the bill clerk for charge against customer.

Work tickets are sent to the billing clerk whose first duty is to locate the streets by Gas Ledger districts. The tickets are then distributed to the Gas Ledger clerks who supply folio numbers corresponding (or as near as possible in case of prepayment meters) to the regular meter account for each particular street number.

After this all the tickets go to the Appliance Ledger clerk who assorts them in numerical order by districts and then makes a distribution of the sales in accordance with the various income accounts. Tickets are then sent to the bill clerk who bills them through an Accounting Machine.

Equipment

The machine is one which carries a fourteen inch paper and writes a line twelve inches. It is equipped with an adding device for adding total debits, credits, old and new balances.

Control Total

Before the posting medium comes to the machine a control total of the tickets is taken against which the operator must balance.

Order No.

ORDER TICKET

Boston, ________________ 192__

Binder Folio

Checked by

Name

Date

Address

Key and Instructions

Location

Telephone No.

Account No.

How

Taken By

Charge to

Is Meter In?
Is Meter Ordered?

Is Service In?
Is Service Ordered?

The subscriber requests the BOSTON CONSOLIDATED GAS COMPANY to furnish and install

for which he agrees to pay $ at time of order and $ each month thereafter until the sum of $ has been paid, until which time the appliance shall remain the property of the BOSTON CONSOLIDATED GAS COMPANY.

All bills are due upon presentation. The Company reserves the right to discontinue the supply of gas upon 24 hours' notice if bills are not paid promptly.

Received on above agreement $

BOSTON CONSOLIDATED GAS CO.

By Date

Sign on this line

14624-25m-9-21

Exhibit A—Actual Size 9¼" x 6"

Reverse side of ticket used for information for lease account and for charge account.

Order No.

CUSTOMER'S COPY OR RECEIPT

ORDER TICKET

Boston, ________________ 192__

Binder Folio

Checked by

Name

Date

Address

Key and Instructions

Location

Telephone No.

Account No.

How

Taken By

Charge to

Is Meter In?
Is Meter Ordered?

Is Service In?
Is Service Ordered?

The subscriber requests the BOSTON CONSOLIDATED GAS COMPANY to furnish and install

for which he agrees to pay $ at time of order and $ each month thereafter until the sum of $ has been paid, until which time the appliance shall remain the property of the BOSTON CONSOLIDATED GAS COMPANY.

All bills are due upon presentation. The Company reserves the right to discontinue the supply of gas upon 24 hours' notice if bills are not paid promptly.

Received on above agreement $

BOSTON CONSOLIDATED GAS CO.

By Date

Sign on this line

14624-25m-9-21

Exhibit B—Actual Size 9¼" x 6"

Reverse side of ticket used for listing materia'.

Order No.	SHOP ORDER Boston, ______ 192__	Executed by
Checked by	Name	Date
Key and Instructions	Address	Telephone No.
Account No.	Location	Taken By
Is Meter In? Is Meter Ordered?	How Charge to	Is Service In? Is Service Ordered?

The subscriber requests the BOSTON CONSOLIDATED GAS COMPANY to furnish and install

for which he agrees to pay $ at time of order and $ each month thereafter until the sum of $ has been paid, until which time the appliance shall remain the property of the BOSTON CONSOLIDATED GAS COMPANY.

All bills are due upon presentation. The Company reserves the right to discontinue the supply of gas upon 24 hours' notice if bills are not paid promptly.

Received on above agreement $ BOSTON CONSOLIDATED GAS CO. By Date	Sign on this line Appliance and Fittings delivered by Team Appliance connected satisfactorily Signature Signature

14624-25m-9-21

Exhibit C—Actual Size 9¼" x 6"

Order No.	SHOP OFFICE FILE Boston............192.....	
	Name	
Key and Instructions	Address	
	Location	Telephone No.
	How	Taken By
Is Meter In? Is Meter Ordered?	Charge to	Is Service In? Is Service Ordered?

Out to measure..........
Measured ....
Holding for stock..........
Holding for notification..........
Stock ordered..........
Stock received..........
Sent to..........
Cut out..........
...r delivery..........
...ered..........
Work being done..........
Meet Inspector..........
Completed..........

14624-25m-9-21

Exhibit D—Actual Size 9¼" x 6"

First Step

When an account becomes active the first step is to insert a set of forms, consisting of ledger and bill, into the machine. These forms are filled with carbon sheets beforehand so no time is lost by the operator.

The following data is posted to the ledger and bill:

- Name of customer
- Address of customer
- Date of invoice
- Description of items
- Amount of items
- Total of items
- Old balance
- New balance

Amounts Affected

As the operator writes the amounts the machine automatically accumulates them in a vertical totalizer and also in a cross totalizer. The vertical totalizers store the amounts up and at the close of the day's work show the total amounts posted.

As each item is written in the amount column it is added in the cross totalizer. When the bill is finished the amount found in the cross totalizer is the total of the bill and this is copied into the Total column. The carriage of the machine is next jumped to the Old Balance column and the last amount found in the New Balance column is written here which is automatically added to the amount of invoice which is already in the cross totalizer, making the new balance which is written in the New Balance column.

Proof of Clearance

If the operator for any reason should copy the wrong amount the machine will not clear, thereby locking the machine so that it will be impossible to write any more figures in any of the columns until the correction has been made.

When the operator has finished posting to all the accounts active for the day, the following totals have been automatically accumulated as a by-product of the typing operation:

Total of amounts written on statement.
Total of previous or old balances.

Posting to Control

These totals are checked by head bookkeeper to see that they are correct. If they check with the predetermined totals, the amount of debit or credit is posted to the control card which is the same as an individual ledger card. As the amount is written, it is cleared from the totalizer over this column but thrown automatically into the cross totalizer. The old balance on the control card is then picked up and the new balance which is shown in the cross totalizer is written in the New Balance column. This new balance is the trial balance figure up to the date of postings made.

Value of Figures Accumulated

The figures shown in the totalizers at the end of a day's posting prove that:

Every charge ticket has been posted.

Every amount has been copied correctly.

Every charge ticket has been added correctly.

Every old balance has been picked up correctly.

When Out of Balance

Should the control totals of billing disagree, it will simply be necessary to check the total on each account with the total on the listing strip. This will locate any ticket not posted or posted incorrectly. Should the total of the old balance disagree with the control, it means comparison of two tapes, one made by the tally

BOSTON CONSOLIDATED GAS CO.
NEWTON DIVISION

308 WASHINGTON ST.
NEWTON, MASS.
TEL. NEW 0980

683 MAIN ST.
WALTHAM, MASS.
TEL. WAL. 0027

DATE	DESCRIPTION	AMOUNT	TOTAL	CREDIT	OLD BALANCE	NEW BALANCE

THIS SHEET IS PAT'D BY KALAMAZOO LOOSE LEAF BINDER CO. - PAT. NOS 1,174,488 - 1,187,948 - 1,239,709 63037

Actual Size 9⅝" x 6⅝"

BOSTON CONSOLIDATED GAS CO.
NEWTON DIVISION

308 WASHINGTON ST.
NEWTON, MASS.
TEL. NEW 0980

$

683 MAIN ST.
WALTHAM, MASS.
TEL. WAL. 0027

(DETACH HERE) PLEASE ENCLOSE THIS STUB WITH YOUR CHECK. YOUR CANCELLED CHECK IS A RECEIPT. IF YOUR CHECK IS LESS THAN THE TOTAL AMOUNT OF THIS STATEMENT, PLEASE RETURN THIS BILL WHEN YOU REMIT

DATE	DESCRIPTION	AMOUNT	TOTAL

ALL CLAIMS TO BE MADE WITHIN FIVE DAYS
ADDRESS ALL COMMUNICATIONS TO 308 WASHINGTON STREET, NEWTON

Kalamazoo Loose Leaf Binder Co., Kalamazoo, Mich. X-6003

Actual Size 9" x 6⅝"

Reason given for non-payment of bill

Collector's Report

PAYMENT ON

ACCT. RENDERED

BOSTON CONSOLIDATED GAS COMPANY
Newton Division

GAS APPLIANCE STATEMENT
MONTHLY SETTLEMENTS REQUIRED

BOSTON CONSOLIDATED GAS CO.
NEWTON DIVISION

308 WASHINGTON ST., NEWTON
TEL. NEW. 0980

683 MAIN ST., WALTHAM
TEL. WAL. 0027

DATE____________APPLIANCE LEDGER____________

ADDRESS ALL COMMUNICATIONS TO 308 WASHINGTON ST., NEWTON

ACCT. RENDERED

PAYMENT ON

MAIL PAYMENTS WITH STUB
BRING THIS BILL AND STUB WHEN YOU PAY AT OFFICE

BOSTON CONSOLIDATED GAS COMPANY
NEWTON DIVISION

CASHIER'S COUPON

IF PAID BY CHECK OR MONEY ORDER, AND NO RECEIPT IS DESIRED, PLEASE DETACH THIS COUPON AND FORWARD WITH YOUR REMITTANCE.

other side

BILLS MAY BE PAID AT THE FOLLOWING OFFICES OR IF MORE CONVENIENT AT THE LOCAL PAY-STATIONS WITHOUT EXTRA CHARGE.

308 WASHINGTON ST., NEWTON
683 MAIN ST., WALTHAM
149 TREMONT ST., BOSTON

LOCAL PAY STATIONS IN NEWTON DIVISION

L. W. Simonds: Watertown	Geo. A. Edmands: Newtonville
Wm. Hahn: Newton Centre	E. W. Keys: Auburndale
Geo. W. Hunt: West Newton	T. A. WEST & Co.: Wellesley Hills
J. A. Morgan & Co.: Wellesley	T. L. Aiken: Newton U. Falls
	F. T. Willey: Newton Highlands

T. J. Breslin: Mt. Auburn St., Watertown

BILL DELIVERED BY DATE__________

BOSTON CONSOLIDATED GAS COMPANY
NEWTON DIVISION

ACCT. RENDERED

PAYMENT ON

Actual Size 12" x 4¼"

when billing and one made by listing afterwards. Either one of these operations requires but little time.

Cash and Merchandise

The posting of all credits is done in the same way as outlined for debits for the amounts posted automatically subtract from the machine instead of add.

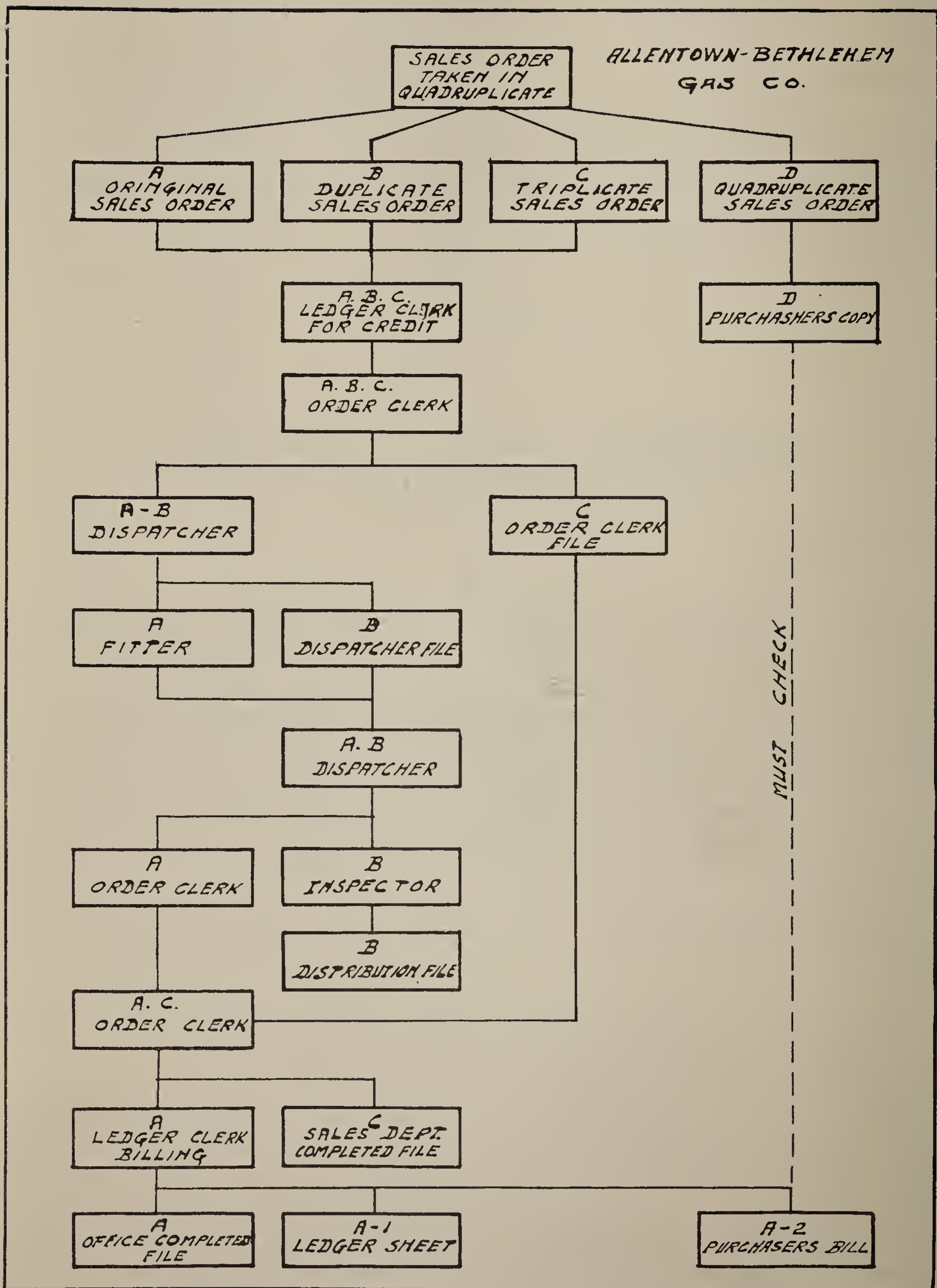
Appliance bills (originals) are mailed just as soon as completed. Each day the bill clerk is advised to make statements on appliance accounts over thirty days old corresponding to the meters that are being read that day. These statements are then sent out with the current gas bills, being delivered by the collectors. The Collection Department attempt to collect on presentation.

MERCHANDISE ACCOUNTING SYSTEM USED BY THE ALLENTOWN-BETHLEHEM GAS CO. ALLENTOWN, PA.

All orders are written on a Combination Sales and Shop order in quadruplicate. (See Exhibit A.) The quadruplicate is the customer's copy, the remaining three copies go to the ledger clerk for approval of credit and terms of payment. If approved, the three copies are sent to the order clerk, who stamps the same number on each copy with a triplicate Bates numbering machine, and with a time dater stamps the time it is dispatched to the shop.

The triplicate is retained in the office. The original and duplicate are sent to the shop for execution. The shop holds the duplicate against the fitter until the original is returned completed. The duplicate is retained by the shop for the inspector and then becomes a part of the shop completed file. The original is returned to the office and the triplicate removed from the office file. The triplicate is sent to the Sales Department for their records. The original is sent to the ledger clerk, who numbers all orders consecutively, then enters the order number in one column, total amount of the order in another and the various amounts under the classifications to be credited with the sales, on a sales and spreader sheet (see Exhibit B), from which sheet the merchandise ledger is charged, and the various classifications are credited at the close of business for the month. He then (with the use of a typewriter) transcribes the items, terms and order numbers from the order to the ledger sheet (see Exhibit C), the carbon copy (see Exhibit D) being customer's bill.

The orders are folded to fit 3 x 5 drawers and are filed away numerically for quick reference. The ledger sheets are filed in a loose leaf binder in the same geographical order as the gas accounts for convenience of placing amounts due on gas bills. The copies or customers' bills are folded to fit an outlook envelope and are mailed daily.


ALLENTOWN-BETHLEHEM GAS CO.
SALES ORDER TAKEN IN QUADRUPLICATE
A ORINGINAL SALES ORDER
B DUPLICATE SALES ORDER
C TRIPLICATE SALES ORDER
D QUADRUPLICATE SALES ORDER
A. B. C. LEDGER CLERK FOR CREDIT
D PURCHASHERS COPY
A. B. C. ORDER CLERK
A-B DISPATCHER
C ORDER CLERK FILE
A FITTER
B DISPATCHER FILE
A. B DISPATCHER
MUST CHECK
A ORDER CLERK
B INSPECTOR
B DISTRIBUTION FILE
A. C. ORDER CLERK
A LEDGER CLERK BILLING
C SALES DEPT. COMPLETED FILE
A OFFICE COMPLETED FILE
A-1 LEDGER SHEET
A-2 PURCHASERS BILL

COMBINATION ORDER—ORIGINAL

ALLENTOWN-BETHLEHEM GAS CO.

ALLENTOWN—BETHLEHEM—SOUTH BETHLEHEM—CATASAUQUA, PA.

References

If Lessee Employer's Name and Address

Remarks:

Displacement ____ All Gas Kitchen ____

FOLD HERE

S. S. Order No.	District	Order Date
5303		

Address

Name

FOLD HERE

Ordered by ____ Amt. of Order

Per ____ Amt. Paid

Relation ____ Bal. Due

Terms

Solicitor ____ Date ____

Above work satisfactorily completed and in good order

Signed

Date ____ Orderman ____

1	17
2	18
3	19
4	20
5	21
6	22
7	23
8	24
9	25
10	26
11	27
12	28
13	29
14	30
15	31
16	

MAIN IN?

SERVICE IN?

USING GAS?

REG OR P P APP?

HOUSE PIPED?

FUEL RUN IN?

Exhibit A—Actual Size 5″ x 8⅝″

Reverse side of original and triplicate tickets used for report of time and material

SUNDRY SALES—MONTH OF 192

Exhibit B—Actual Size 26¾″ x 16⅞″

S. S. ORDER NO.

ALLENTOWN, PA.,

MR

TERMS:

			DEBITS	CREDITS		DR. BALANCE	DELINQUENT	
				DATE	AMOUNT		TO	AMOUNT

Form for installment sales.

SALES ORDER NO

SOLD TO MR.

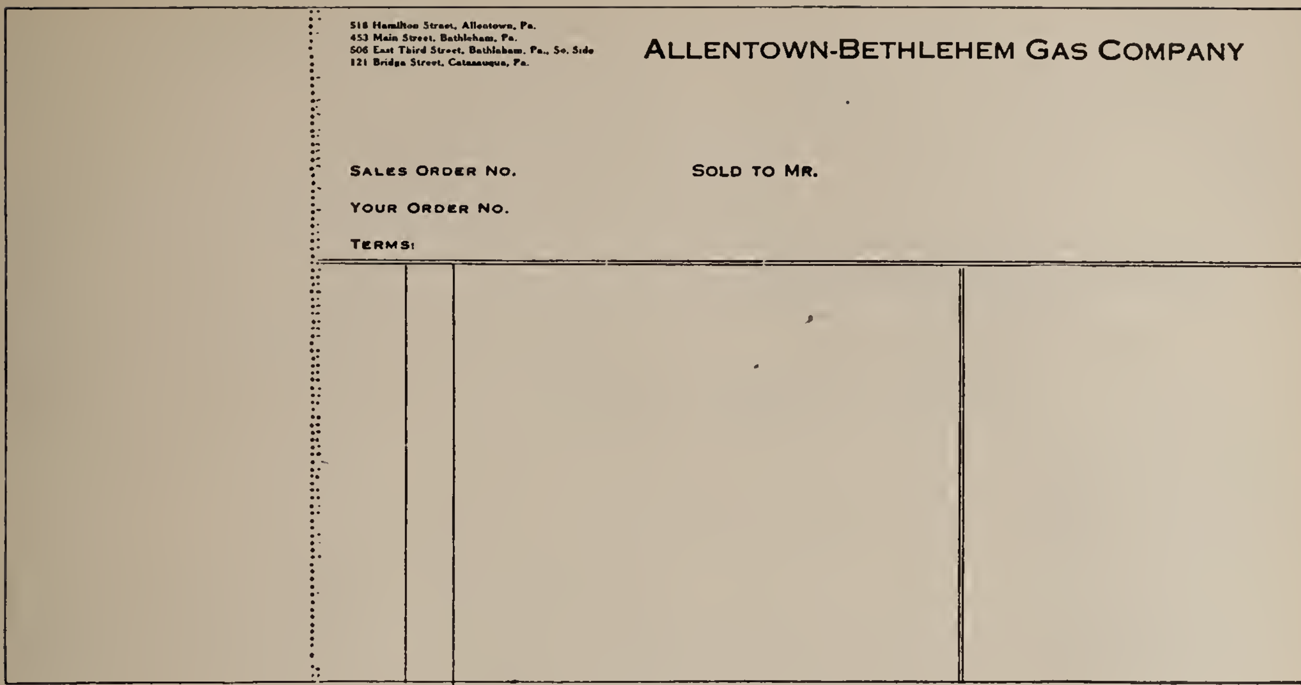
YOUR ORDER NO

TERMS:

			DEBITS	CREDITS		DR. BALANCE	DELINQUENT	
				DATE	AMOUNT		TO	AMOUNT

Form for 10 and 30 day sales.

Exhibit C—Actual Size 11⅞" x 6¼"



518 Hamilton Street, Allentown, Pa.
453 Main Street, Bethlehem, Pa.
506 East Third Street, Bethlehem, Pa., So. Side
121 Bridge Street, Catasauqua, Pa.

ALLENTOWN-BETHLEHEM GAS COMPANY

SALES ORDER NO. SOLD TO MR.

YOUR ORDER NO.

TERMS:

Exhibit D—Actual Size 11⅞" x 6¼"

MERCHANDISE ACCOUNTING SYSTEM USED BY THE ROCHESTER GAS & ELECTRIC CORPORATION, ROCHESTER, N. Y.

Merchandise Contract (Exhibit "A")

Written up in duplicate by salesperson and after it has been favorably passed upon by the credit department, presented to the cashier with initial payment. The cashier receipts both copies and gives copy No. 2 to customer while the sales department summarizes copy No. 1 on contract summary (Exhibit C) and sends both contracts and summary to the order department. The order department issues the work order (Exhibit B) and forwards contracts and summary to the merchandise billing department where the contracts are held for the receipt of the completed work order to which they are fastened after being compared.

Work Order (Exhibit "B")

Using the contract (Exhibit A) as a base the work orders are written up in triplicate by the order department which retains copy No. 3 as a follow-up and forwards copies Nos. 1 and 2 to the shops. The shop office holds copy No. 2 in an uncompleted file while copy No. 1 is given to the foreman and is his authority for drawing material from stock. The materials used and the hours of labor are recorded on copy No. 1 and upon completion of the work it is returned to the shop office where copy No. 2 is then transferred to a completed job file. The shop office prices and extends the labor and material on copy No. 1, lists the or-

No.....................................

ORIGINAL

Appliance Contract

Name..

Address...

....

SEE THAT PAYMENTS ARE RECEIPTED FOR

PAYMENTS

RECEIVED ON THE WITHIN CONTRACT

CONDITIONS

It is understood and agreed that the title to the goods and chattels herein described shall be and remain in the seller until the purchase price thereof is fully paid and that such goods and chattels shall remain upon the premises where delivered or installed, and shall not be removed therefrom without the consent of the seller in writing, until the purchase price is paid in full.

It is also understood and agreed that this contract shall not be binding upon the seller until accepted by its General Manager by acceptance endorsed hereon in writing; and the seller agrees that in the event the contract is not accepted by it, it will refund all moneys paid by the purchaser hereon.

The purchaser agrees not to assign, sell or transfer this contract or any interest herein, or in the goods and chattels herein mentioned, without the consent of the seller endorsed hereon in writing; and that in the event of default by the purchaser in the payment of the purchase price or any part thereof when due, the seller may, at its option, retake said goods and chattels, and perform any and all acts necessary for that purpose, and that upon so doing, this contract shall be deemed cancelled and annulled.

DATE		AMT.	BY
	19	$	
	19	$	
	19	$	
	19	$	
	19	$	
	19	$	
	19	$	
	19	$	
	19	$	
	19	$	
	19	$	
	19	$	
	19	$	

G-43

ROCHESTER, N. Y.,..................................192...

THE ROCHESTER GAS & ELECTRIC CORPORATION

the seller, agrees to deliver at________________________________
in the city of Rochester, N. Y., and upon the purchase price being paid in full, as hereinafter specified, to execute and deliver to________________________________

the purchaser, residing at________________________________
in said city, a bill of sale of the following:

No.			Amount

For which the purchaser agrees to pay the sum of ($) Dollars, as follows:

($) Dollars on signing this contract, receipt of which is hereby acknowledged, and ($) Dollars at the main office of the seller on the ________day of________________19____ and each succeeding month thereafter until the whole purchase price is paid.

ABOVE GOODS ARE SOLD SUBJECT TO CONDITIONS ON BACK HEREOF WHICH ARE HEREBY AGREED TO

Witness the hands of the parties________day of________________19____

ROCHESTER GAS & ELECTRIC CORP.

APPROVED By________________________

________________Gen. Mgr. ________________________

THE SHELBY SALESBOOK CO., SHELBY, OHIO. 368-K

Exhibit A—Acutal Size 4⅝" x 7⅜"

ROCHESTER GAS & ELECTRIC CORP.

DETAIL OF LABOR ON THIS ORDER

EMPLOYEE	DATE AND HOURS WORKED									TOTAL HOURS	RATE	AMT.

PRICED BY ____________ EXT. BY ____________ EXT. CHECKED BY ____________

ORIGINAL GAS DEPT. ORDER COMPLETED

NO.____________ DATE ____________192____ NO.____________

CHARGE ACCOUNT NO. { ____________

CONSUMER________________________

LOCATION________________________

CHARGE TO________________________

ADDRESS________________________ AMOUNT

SEE ORDER FOR ____________________ TOTAL

SERVICE IN____________METER____________ORDER NO.____________

REMARKS________________________

TERMS____________________SALESMAN____________

DATE____________192____ I HAVE THIS DAY COMPLETED ABOVE ORDER

S. S.____________INVOICE____________SIGNED____________

REPORT LABOR AND MATERIAL USED ON BACK OF THIS ORDER

REPORT OF MATERIAL AND LABOR

QUANTITY	ITEM	PRICE	AMT
	FT. OF IN. W I PIPE		
	" "		
	" "		
	" "		
	IN MAL FITTINGS		
	" "		
	" "		
	" "		
	" "		
	IN UNION		
	" "		
	" "		
	IN. COCK		
	" "		
	TOTAL MATERIAL		
	HOURS TIME (FOR DETAIL SEE OTHER SIDE		

MATERIAL ENTERED TOTAL

Exhibit B—Actual Size 5½" x 8"

ders on a summary sheet (Exhibit D) and sends them to the order department where copy No. 3 is pulled and destroyed.

Both copy No. 1 and summary are forwarded to the merchandise billing department where the orders (copy No. 1) are compared with the contracts (Exhibit A) checked as to prices and extensions and placed in order for billing. An adding machine listing is taken off for the posting control (Exhibit E) entries made on the ledger cards (Exhibit H-I) and the orders forwarded to the Tabulating Department. After a tabulating card (Exhibit L) has been punched the orders are returned to the merchandise billing department and filed by charge numbers.

Contract Summary Sheet (Exhibit "C")

Contract summary sheets are used by the sales department in reporting their sales for the day and accompany the contracts to the order department. From the order department it is sent to the merchandise billing department where it is checked to prevent loss of contracts and filed for future reference.

Order Summary Sheet (Exhibit "D")

This summary sheet accompanies all orders and is checked by every department receiving it to prevent errors or loss of orders. It is used by the order department in forwarding new orders to the shops and also by the shops in reporting completed work orders through the order department to the merchandise billing department where it is filed for future reference.

Posting Control (Exhibit "E")

Daily all the debits (Dr. transfers—

OFFICE FLOOR SALES For________ _______192_

Name	Address	Ranges	Water Heater	Sundries	Salesman

Exhibit C—Actual Size 8½" x 11"

completed work orders and sales) and all the credits (Cr. transfers, cash and allowances) are pre-listed and the totals for each ledger entered on a posting control.

As the machine operators complete the posting of a ledger the totals are checked and verified by the control clerk who places the initials of the operator and checker in the spaces provided therefor.

This control is a summary of the day's work as shown by the proof sheets (Exhibit J) and is filed away after the ledger control has been balanced.

Form E 96-B

ROCHESTER GAS & ELECTRIC CORPORATION

REPORT OF APPLIANCE ORDERS COMPLETED FOR ____________ 19____

Order No.	Name of Customer	LOCATION		Nature of Work	Office Charge No.
		No.	Street		

Issued by	Dept. Date	REMARKS
Written by		
Verified by		

Exhibit D—Actual Size $8\frac{1}{2}'' \times 7\frac{3}{8}''$

Cash Ticket (Exhibit "F")

During the day three listings are made of the cash tickets taken in by each teller and the grand total proved against the amount of cash reported. The tickets are then passed through the sorting and checking group who check the tickets against the listing, sort the tickets by ledgers and streets for posting and forward them to the merchandise billing department. An adding machine listing (the grand total of which must agree with the grand total of the tellers' listing) is drawn off for the posting control (Exhibit E) and after the cash tickets have

BUDGET NO		SALES OF			CASH OF					
LEDG	OLD BAL	DR. TRANS	SALES	TOTAL DR.	TOTAL CR.	CR. TRANS.	ALLOW & DISC.	CASH	PSTD BY	OKD BY
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
TOTAL										

Exhibit E—Actual Size 8½" x 10¾"

been posted on the ledgers they are filed by days for reference.

ROCHESTER GAS & ELECTRIC CORP
APPLIANCE BILL

G-16

Ledger No. ____________

Name ____________

Address ____________

Date		Item		

Exhibit F—Actual Size 3¼" x 4¼"

Allowances (Exhibit "G")

When material is returned for credit an allowance slip is issued and forwarded to the Merchandise Billing Department. They are listed with the cash tickets but as a separate total for the posting control (Exhibit E) posted to the ledger card and forwarded to the Tabulating Department. After a tabulating card has been punched the allowances are returned to the Merchandise Billing Department for reference.

Billing Statement (Exhibit "H")

Copy No. 1 is a bill and statement combined and is rendered the first of every month to all customers with the exception of Business Houses which are also given individual bills. At the end of the month as soon as the last day's cash has been entered both copies No. 1 and No. 2 are pulled, copy No. 1 being sent to the Mailing Department while copy No. 2 is turned over to the Collection Department for their use in following up delinquent accounts. The accounts are divided into twenty-three (23) ledgers and one of these scheduled for collection each day. All calls and promises made on partial payments received are noted on statement which is destroyed when items have been paid in full.

Ledger Card (Exhibit "I")

New ledger cards are written up from the posting items. After the posting control (Exhibit E) has been established the items to be posted are given to a stuffing clerk who clips them to the proper ac-

E 12
LEDGER NO. ALLOWANCE NO.____________

ROCHESTER GAS & ELECTRIC CORP.
CODE NO.________ DATE ____________ 19 .

ACCT. NO. ____________ AMOUNT ____________

ACCT. NO. ____________ AMOUNT ____________

NAME ____________

ADDRESS ____________

Allowance for charge of ______ NO.____________

Made by ______ Credit Memo. issued ______
Auth'zed by ______ Corrected bill " ______
Checked O.K. ______ Pink Card issued ______
O.K.Chief Clerk ______ O.K.Auditor ______

Exhibit G—Actual Size 4¾" x 6⅞"

count and makes a list of the old balances of the accounts affected. The total of the old balances for each ledger is en-

tered on the posting control (Exhibit E) and the ledgers turned over to the machine operator. Postings are made by the Elliott-Fisher Bookkeeping machine and are written on the Customer's Statement, Collector's Statement, Ledger Card and Proof Sheet at one time. After the ledgers have been balanced the paid up ledger cards are pulled and filed with the closed accounts.

Proof Sheet (Exhibit "J")

The outstanding feature of the Elliott-Fisher is the proof sheet. It is a dupli-

G & E-169 A

TO ROCHESTER GAS & ELECTRIC CORP., DR.
MONTHLY APPLIANCE STATEMENT

AMT. PAID, $

DETACH THIS STUB AND MAIL WITH YOUR CHECK LEDG. NO. PAY LAST AMOUNT IN THIS COLUMN

OLD BALANCE	DATE	ITEMS	CHARGE NUMBER	CHARGES	√	CREDITS	BALANCE
		ACCOUNT RENDERED					

ROCHESTER GAS & ELECTRIC CORP. PAID 19 CHECK NO.

Exhibit H—Actual Size 8½" x 7⅝"

On the last day of the month a trial balance is taken off and it must agree with the ledger control which is later balanced with the controlling account in the General Ledger. After the ledgers have been balanced the paid up ledger cards

cate record of every entry made on the ledger cards and at the completion of a ledger run the totals of the various columns are copied down and proved out. It is later checked with the ledger control and filed for reference.

Ledger Control (Exhibit "K")

The ledger control is a monthly record on which the posting controls are entered daily and carries the net balance of each ledger. As each day's work is completed the totals on the proof sheets (Exhibit J) are checked against the ledger control which must also agree with the trial balance of the ledgers at the end of the month. They are filed with the proof sheets for reference.

Tabulating Card (Exhibit "L")

Tabulating cards are punched for only the work orders, sales and allowances and are tabulated to agree with the totals of the daily posting control. At the close of the month's business these cards are tabulated for the grand total which is proved with the Merchandise Billing Department total and then distributed to the various account numbers.

A separate report is made of the Sales and Allowances these reports being the basis of the Journal Entries on the General Ledger Controlling Accounts. After making an additional report on the coke sales for the Coke Department the cards are filed away.

FORM G & E 170

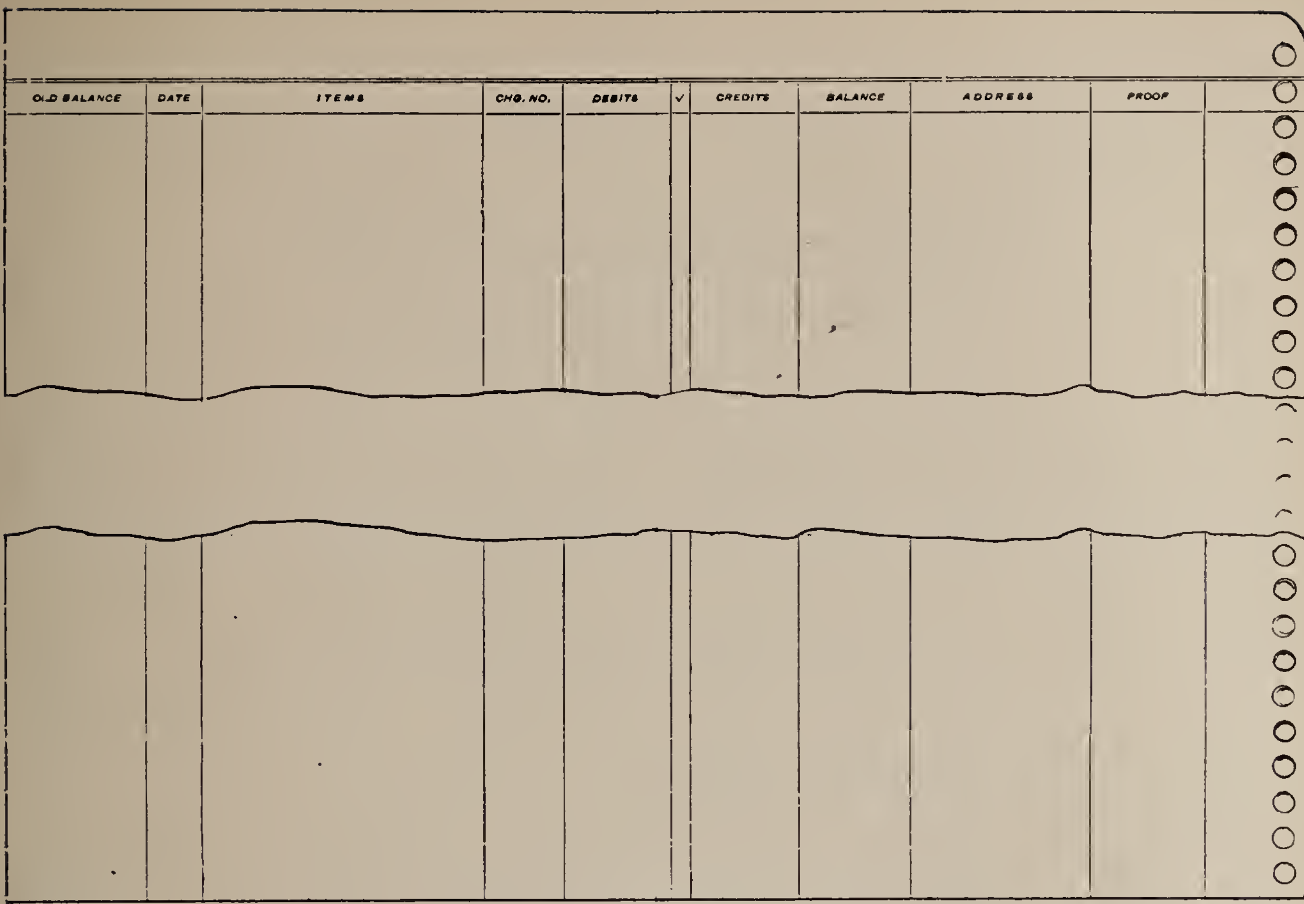
ROCHESTER GAS AND ELECTRIC CORP.

PAYMENTS MADE		PAYMENTS DUE	

"Y AND E" ROCHESTER N.Y. — [illegible]

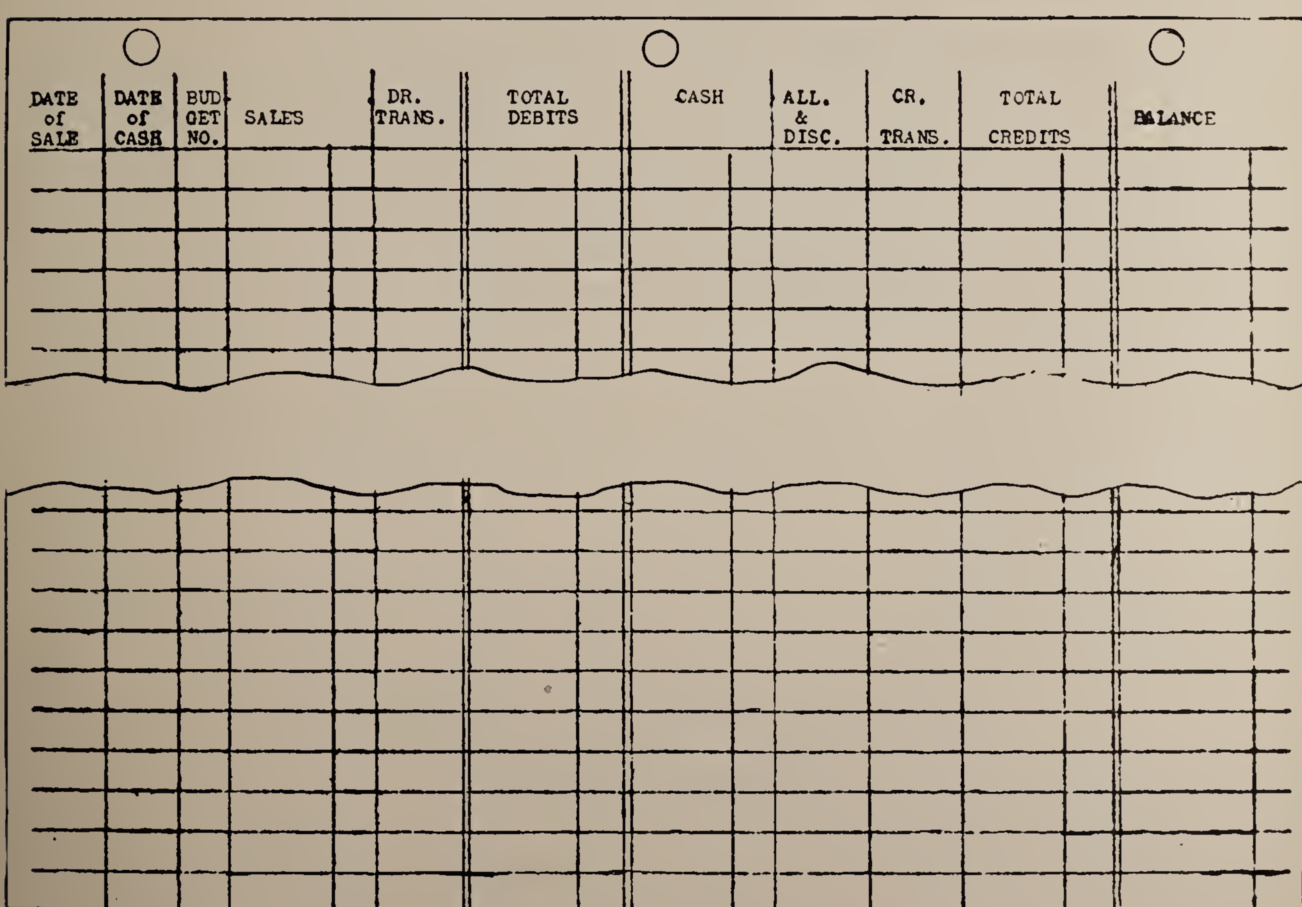
	OLD DALANCE	DATE	DESCRIPTION	CHARGE NUMBER	DEBITS	√	CREDITS	BALANCE	

Exhibit I—Actual Size 10" x 8"



OLD BALANCE	DATE	ITEMS	CHG. NO.	DEBITS	✓	CREDITS	BALANCE	ADDRESS	PROOF

Exhibit J—Actual Size 11" x 11¾"



DATE of SALE	DATE of CASH	BUDGET NO.	SALES	DR. TRANS.	TOTAL DEBITS	CASH	ALL. & DISC.	CR. TRANS.	TOTAL CREDITS	BALANCE

Exhibit K—Actual Size 8½" x 11"

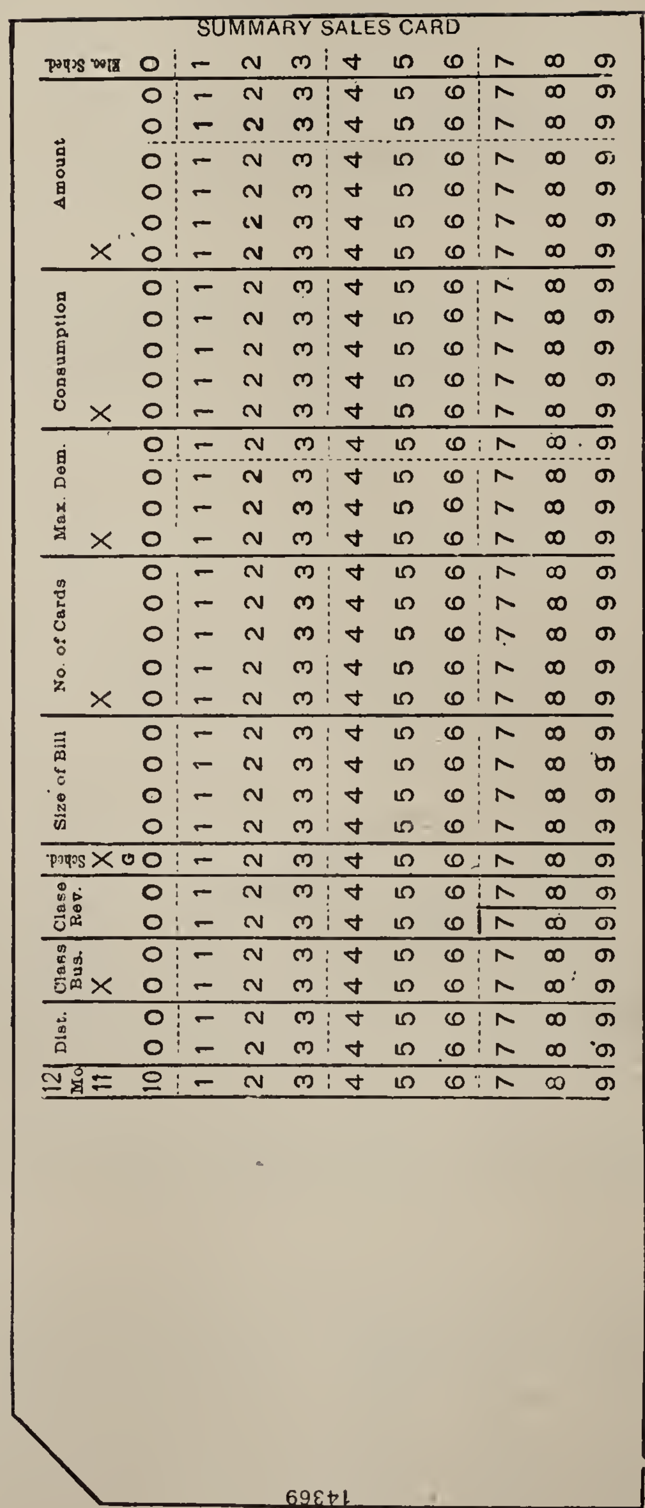


Exhibit L

Actual Size 3¼" x 7⅜"

MACHINE BILLING AND BOOKKEEPING AS IN FORCE AT PORTLAND GAS & COKE COMPANY

Wm. H. Barton, Portland, Oregon.

The majority of our fifteen bookkeeping machines have been in use over two years; an ample length of time to work out all details in connection with their use and in which to judge the results. A detailed description of the application of the machines to our customers' ledgers follows:

We have 75,000 customers' gas accounts. The debit posting and cash posting on such accounts, as well as the rendering of the bills, is handled on the machines, also the control sheet posting. There are each month about 3,500 "final" debit postings, consisting of locked meter orders for premises being vacated, which are not handled on the machines but by the hand or pen-and-ink method, for the reason that they involve changes in the headings of the sheets which cannot be made on the machines. Both entries are, therefore, made at the same time; however, the bills for such entries are made on the machines, thus providing the same proof of the accuracy of the work.

Of the fifteen machines, five are used for debit posting, five for billing, four for credit posting, and one for ledger control sheets. These machines, which have automatic carriage movements, were installed only after thorough investigation of somewhat similar machines in use in other cities, as well as different machines made by other manufacturers. We also carefully considered the different kinds of equipment usable with the machines, and finally adopted the Tatum, three-inch, compression binders because of their permitting more rapid handling of the sheets, as the ledger itself forms a rack or tray without splitting the binder. The use of separate binders permitted greater flexibility in the vast amount of reference to the accounts which is necessary and in the large number of written changes which it is necessary to make in the headings of the sheets, all without the accompanying inconvenience of lost or misplaced pages usual with other forms of filing sheets. Such binders are provided with quick-operating lock posts as a safeguard in the event ledgers are dropped. The 196 ledgers are filed in 11 roller shelf cases with celluloid tops, under which are placed the ledger charts, the accounts being carried in street order. Fifteen women operate the machines at speeds equal to any we were able to secure with men. Two boys are employed to carry ledgers back and forth for the machine operators to save time and confusion. When ledgers are removed from the cases, name plates are inserted so that anyone desiring to see any such ledgers can easily locate them.

The ledger sheets are 11″ x 16″ in size and are designed for a period of five years. Spaces are provided and designated for each month of such period. The sheets are intended to cover the dif-

ferent customers' premises and, therefore, remain in the ledgers permanently, any changes of tenants or meters being simply noted on the headings of the sheets. In some apartment houses changes occur with such frequency that special "fly" pages are provided on which such information only is recorded. We preferred to provide special spaces for each individual month so that in the event payments on account are made, room is afforded for the different postings, also, in taking off balances or looking up information, a given month is always found at the same location on all the sheets. This company does not install prepay or quarter meters as head meters, installing them only as rented supplemental meters for which $0.15 each per month is charged. We do not read or collect from such meters, therefore special ledger pages are designed for the recording only of such meters, the notation covering the rental charges to be made each month being on the head meter sheets.

We do not use meter reading books as we consider their maintenance a useless expense. All changes of names, meter numbers, etc., are, of course, made on the addressograph plates, therefore, under the continuous reading system we print on the addressograph a given number of bills each day and at the same time a "tape" (double width adding machine paper) is also printed for each meter reading route. The reading media for each man is, therefore, automatically up-to-date at all times. The meter readers, having no previous readings, cannot fake the current month's readings. These tapes form the items of original entry in posting debits.

Two clerks are assigned to keeping track of the work in progress and the reconciliation of debit posting tapes and billing tapes, also the calculation of bills over 10,000 cubic feet which do not show in rate books. The meter reading rolls together with the bills are first turned over by such clerk to the debit posting clerks, who insert the ledger pages in the machines and make the necessary postings, securing automatic subtractions of the readings. The gross amounts for such consumptions are secured from charts which are placed on racks fastened to the floor immediately back of the machines to eliminate difficulty from vibration which would exist with the racks attached to the machines. These charts, one for house-heating rates and one for domestic rates, cover bills for normal months (approximately 30 days) from 0 to 10,000 cubic feet. Yellow cardboard is used instead of white on account of reflecting less light, thereby reducing the glare; at the same time, the black printing shows more vividly than on white. The cubic feet figures are underlined with red ink to make them more easily located. Printed handbooks are provided for consumptions over 10,000 cubic feet and for bills which cover periods over and under a normal month.

Each of the five debit posting machines is provided with a carbon tally roll on which is automatically printed the cubic feet consumption and the gross amounts. In the event a meter has been skipped in reading or the posting clerk thinks a reading is incorrect, the bill is set aside so that it will not be sent to the billing clerk but a re-read order written by the boy who carries ledgers. When completed, the reading rolls, carbon tapes and bills are returned to the work-in-progress clerks. All such items are later assigned to the billing clerks who insert the bills in the machines and from the parallel ledger accounts copy the

previous reading and date, current reading, consumption and gross amount. The net and discount amount which are also printed by the machines are secured from charts similar to those used by the debit posting clerks, the amounts being located by using the cubic feet figures so as to bring to light any errors on the part of the debit posting clerks in selecting the gross amounts. The billing clerks print on the bills prepay meter rental charges, also all unpaid back balances, the latter items not adding in the machine but printed only. Notations such as "Mdse." or "Arc Maint." are noted on the bills for instructions to send such bills for the entry of merchandise or arc maintenance charges.

The billing machines list and add the gross, discount and net amounts. They also add but do not list the previous readings, current readings and consumptions. When completed, such tapes, bills and debit carbon tapes are returned to the work-in-progress clerks; who add the carbon debit posting tapes on a calculator. The totals of the gross amounts on such tapes must agree with parallel totals on the billing tapes, the totals of the consumptions must agree with the totals of the consumptions on the billing tapes, the totals of the net amounts and the discount amounts on the billing tapes must agree with the totals of the gross amounts on the same tapes. Likewise, the totals of the previous readings subtracted from the totals of the present readings on the billing tapes must agree with the totals of the consumptions on the same tapes. It will be seen from this, that if the reconciliation is properly attended to, an absolute proof is afforded on all of the operations.

The cash stubs are taken out of the cash registers by the Ledger and Billing Division stub clerk (the cashier and tellers do not have keys to the cash register stub boxes). After all such stubs are sorted by ledger numbers, the stub clerk adds them as to cash and discount, balancing with the cash register totals and the total cash. The cash stubs, together with the adding machine tapes, are then turned over to the work-in-progress clerks, who, in turn, assign them to the credit posting clerks, who insert the pages in the machines and post the cash and discount. After the stubs for a given ledger have been posted, the clerk observes the two totals in the machine and compares them with the parallel totals on the stub clerk's tape. In the event they balance, the credit recapitulation sheet for the day is inserted in the same machine and in the proper space for such ledger the totals are printed, being automatically transferred in the machine to the total cumulating counters. After all ledgers have been posted, the grand totals in the four machines are added together and filled in in the total space on the credit sheet. In the event each ledger's totals have been properly compared, the grand total will, of course, balance. A recapitulation by ledgers of the credits for the day is thus automatically obtained. The stubs, tapes and credit sheet are then returned to the work-in-progress clerk who recompares the totals only as a final check.

The carbon tapes for the "regular" and "miscellaneous" debit postings, also the tapes for the few "final" debit postings, are turned over to the control clerk by the work-in-progress clerk after a day's work is completed. The ledger control clerk inserts a daily debit recapitulation sheet in one of the credit posting machines and prints in the proper spaces for the ledgers the different

totals of each of the tapes. In the event there happens to be "regular," "miscellaneous" and "final" tapes for the same ledger, the three amounts are added into the machine with the carriage held back and then printed on the sheet. The total cubic feet and gross amounts on the billing tapes are added for the day to balance with the debit sheet which proves that all tapes are in agreement. The daily credit recapitulation sheet is obtained automatically, as previously indicated, and is turned over to the control clerk each day.

All gas ledger corrections or debit and credit memorandums are entered on the ledger sheets by hand and turned over to the ledger control clerk.

The ledger control clerk on the first of each month opens a new set of control sheets, one sheet for each ledger and one grand total sheet, and posts thereon the total balance outstanding as of the end of the previous month. Each day the sheets are inserted in the ledger control machine, and from the debit and credit recapitulation sheets and miscellaneous debit and credit memorandums makes the necessary postings to each control sheet, securing automatic additions, subtractions and resulting balances. The grand total control sheet is handled in a similar manner. With this plan, the work at the end of the month is practically no different than the work each day, as it is only necessary to add the six or eight columns on the grand total control sheet and total the recapitulation of miscellaneous debit and credit memorandums and turn the books over to the treasurer's department for journalizing.

All the items entered on the ledgers each day such as reading rolls, re-reads, dial cards, meter lock orders, cash stubs, debit and credit memorandums and adding machine tapes, except debit posting tapes, are filed in 8″ x 5″ pasteboard boxes, one box for each day. In this way, reference may be made to any such items by securing the date of entry from the gas ledgers. The debit posting tapes just mentioned are each day filed in envelopes, one envelope being provided for each ledger for each month. In this way, at the end of a month, all the debit tapes for each ledger are in one envelope so that if in balancing a ledger one desires to check the debit tapes, they are readily available. It will have been noted that no credit tapes are formed at the time of posting, it being thought that such tapes are unnecessary, as a balance with the cashier or stub clerk's totals is made after each ledger is posted.

Shortly after the first of each month, three clerks go through all ledgers and take off a trial balance of the outstanding amounts. Such totals are then compared with the balances as called for by the ledger control sheets. Where differences exist, such clerks check the work and locate any errors which have been made.

In order to enlist the interest of the employes in developing a reasonable speed in the operation of the machines, a bulletin is posted daily showing the results for each individual as well as the total average results for the three operations, namely: debit posting, credit posting and billing, the figures being shown for the day, to date in the current month, and for the preceding month.

The quantity of work now being turned out is as follows:

	Average Speed
Debit Posting	
Regular Readings	125
Re-reads	38

	Average Speed
Billing	
Regular Readings	125
Re-reads	40
Final Readings	50
Credit Posting	
Cash Stubs	105

The total number of men required is as follows:

Operation	Number
Regular and re-read debit posting	5
Regular, re-read and final billing	5
Credit Posting	4
Work-in-progress and calculate large bills	1
Add debit tapes and reconcile all tapes	1
Ledger control sheets	1
Carry ledgers and write re-reads	1
Total	18

This, of course, does not represent all the employes in the ledger and billing division, but those working directly in connection with the machine work. We do not "stuff" the ledgers for the operators and they are responsible for watching accounts for "skips," normal bills, etc.

It is rather difficult for us to compare the costs of doing the work with the machines with the old pen-and-ink method on account of the fact that simultaneously with the installation of the machines, the company's schedule of rates was increased and completely altered, as under the old schedule all sales were entered on the ledgers at $1.00 per thousand cubic feet, the lower rates being taken care of by sliding scale discounts. The new rate structure provides a block system, making it necessary to multiply the different consumption steps by different rates per thousand. It is, therefore, necessary to use charts and rate books covering the dollars and cents equivalents for the different volumes of consumption. This, together with the reference which is necessary in case bills cover more or less than a month, and complicated calculations covering bills for customers having more than one meter, retards the speed at which the work was previously done. Nevertheless, we are convinced that a substantial saving is being made, in any event more than sufficient to cover the maintenance, interest and depreciation of the investment. The machine method is obviously more rapid than the hand method, brought about chiefly by the automatic features such as dating, listing, additions, subtractions, cipher printing, etc. Greater accuracy is obtained because of these features and the records, of course, are much more legible and neat in appearance.

We, therefore, feel that the adoption of the bookkeeping and billing machines has been a move in the right direction, and that mechanical methods are unquestionably supplanting the hand methods in bookkeeping operations, particularly in companies having a large number of accounts.

DISCUSSION

(Costs)

W. H. Barton (Portland, Ore.): I think it is a mighty fine thing to be able to get these figures. I have not gotten my code number yet, but I am very anxious to get it and compare costs.

I would like to see this committee or section go further into these various systems and find out which one really is the most economical. We have the different machine systems to discuss, and the bookkeeping without books and we have exhibits on them. The reports in general cover basic things or principles and I think for the year coming, it

would be well to have the Association employ one or two men on an actual pay basis to go to these various companies and weigh each of the systems and find out a basis of comparison that the committee can get together on and work out something of a standardized character. The committees alone, I do not believe can do that—it takes so much time. But I think it would be well worth the expense for the Association to send one or two men out.

May I cite one method which we have. We do not have meter-reading books and we have not had them for several years. I have never found any other company that got along without meter-reading books. We consider the maintenance of meter-reading books an absolute expense—a waste of time.

The man that you employ might find something in that system; he might find some other idea in Baltimore and another one in Chicago. About ten per cent of the operating expenses of the average utilities are spent in commercial books and I think that next year we could, by that method, present to the various companies a real standardized method that they would be glad to have and do away with their own methods.

In connection with the reading of meters, we have the addressograph which prints the bills each day for each route. Simultaneously we print a double-width adding machine tape which is printed automatically by a device on the addressograph. We have a record of certain streets that are to be read on certain days and these are given to the meter-readers and they cannot play pool all the afternoon and not read meters because they have nothing with them but the name and address and the meter numbers. We carry a code—"A," "B," "C," etc., telling the meter-reader to be careful of the dog, or the meter is located on the north side of the house, and things like that.

In that way, when it is turned in, we consider that the item of original entry. The debit postings are made, bills are rendered and that tape is filed away with all items of original entry. If the consumer comes in and challenges the reading of the meter, we get that tape out and show it to him, and show that the meter-reader had no previous idea about the meter. In that way, we do not have so much extra work in connection with changes and removals, loss of meter-reading books or transfers of new pages to the books, because the addressograph has to be maintained up to date to print the bills. In that way your meter-reading medium is automatically up to date.

William Schmidt (Baltimore, Md.): The Bureau of Commercial Economics has made a study of various bookkeeping systems. I believe if this Association or this section would get in touch with that bureau, both time and money could be saved.

J. L. Conover (Newark, N. J.): We follow along the same line regarding the indexing of meters as just outlined by the gentleman from Portland. We feel that it is a big asset in case of complaints to be able to demonstrate without any argument with the customer, that the man actually got to the premises and saw the meter, because he had no other way of taking the index. We have had some little experience with the other system and we are satisfied that the blind method is the best.

It is difficult to make a comparison of these costs not knowing the conditions that exist in these various companies.

For example: One company may have a discount for prompt payment, another company may not. That will affect the collection cost very materially. But I believe with this paper as a basis, if we go into it properly, we will get a lot out of it from which we will all benefit.

H. F. Frey (Allentown, Pa.): I would like to know what is the cause of the difference between a man operating accounts for $1.09 a year and another at $1.70 a year? Can the committee give us that information or are we supposed to get that individually from the company that turned in the return?

W. G. Murfit (Newtown, Pa.): I have not that data available. I was confined to the questionnaire and the answers were rather extensive. So if you find among this data a company approximately your own size, and you wonder why they are doing better, or why you are doing better, you would have to get in touch with Mr. Hartman at Association Headquarters. You could then get in touch with each other regarding any differences.

W. H. Bischoff (Savannah, Ga.): I would like to ask Mr. Barton of Portland whether or not he has adopted the system of bookkeeping without books?

The Chairman: No, he has not or he would not be doing his work on adding machine strips. He has been over at the exhibit quite often.

W. H. Cassell (Baltimore, Md.): When we attempted to make a comparison of costs in the N. E. L. A. two years ago, we found that the diversity factor was so great that we got into a terrible jam. The companies challenged the figures generally, stating that they had charged in this item and someone else had not.

Last year we compiled a classification of accounts for comparative purposes only, under which each company would charge in the same items.

I merely mention that to let you know that such a classification of accounts is available and could probably fit in with gas operation, or a similar one could be prepared by the committee next year.

DISCUSSION

(Merchandise Accounting)

T. R. Clayton (Providence, R. I.): In regard to the report of this committee, if it were not for the fact that Henry Ford has said that improvement is always possible, it would seem it is the last word on the subject. I have one question that I would like to ask and it is this: Is it customary to segregate the first payments on merchandise installment sales from regular accounts receivable merchandise sales?

W. H. German (Harrisburg, Pa.): The only way the Harrisburg system differs from Allentown is that we get our bills out in the mail the day after completion of the work. Our idea is to work upon a close collection and I would like to stress the item in Mr. Keller's paper regarding the prompt serving of bills and the collections resulting therefrom.

Not all of us realize the importance, or at least are not paying the strict attention to our collections that we should. If you want your customers, particularly those buying on the install-

ment plan, to pay promptly, it will be up to you to serve the bills to them promptly.

On the question of individual ledger balances, we keep our ledgers separate —that is one for each collector and in that way we are able to closely follow up the collection results of each collector and keep in touch with them for good results. The Rochester system of using a ledger card and invoice at one writing is followed out by us, only instead of a card we use the loose-leaf book.

D. L. Bosworth (Nashville, Tenn.): It seems to me that a great many of these papers are taken from the larger companies and are very elaborate. Now the greater number of representatives here are from the small companies. Of course, we can pick out a lot of these things that are beneficial to us, but were we to adopt methods to follow out half of the ideas that have been presented, our cost in keeping them up would be too great.

At Nashville we use the original sales contract for our orders and send to the distribution department. We show on the reverse side of this contract all the materials used in completing the orders. We hold a certificate in the office against this and when it is returned, this material is placed on our storeroom record and all the way through to the customer who receives the bills. The original sales orders are then filed. We can refer to that original sales order to show the personal signature given at the time the order was placed and also on the reverse side when they received the material which we billed them for. We think that is a very good system in a small company.

A. S. Corson (Philadelphia, Pa.): I also believe that half of these systems outlined here are not being used by the smaller companies. I rather favor the Allentown system, particularly that part which cites the original sales order bearing the signature when order is placed and material installed by the fitter. That is quite an advantage.

W. A. Doering (Boston, Mass.): I personally cannot see why any one of these so-called merchandising accounting systems cannot be used by a small company. They are at the present time making out an invoice and regardless of the amount of records they keep, as far as the ledger card and ledger sheet is concerned, it is duplication of work to make out a bill and transcribe the name and total on a card. Invariably, no matter how small the company is, they at least have a typewriter in their office and with the use of carbon paper, the invoice and ledger sheet can be made out from that.

C. M. Finegan (St. Joseph, Mo.): In connection with a small company, we use the original sales contract, which is signed in duplicate by the consumer, as our original ledger account. From that an order is made to send to the shop for the work. The cost figures are worked out from items taken from the storeroom, later shown on the back of the original shop order which is returned and with the amount of charge. As soon as the order comes back from the shop, it is matched against the contract, signed and then the charge is put on our summary of sales and entered in the ledger. The balances are taken from this twice a month against our collections.

We credit advance payments to the customer's account in suspense and carry it as a credit balance against our balances in making a balance of the merchandise ledger.

This paper seems to have overlooked an item in regard to accounting for installment sales. The Federal Income Tax unit says that installment sales may be taken care of either by charging the entire cost of merchandise sold and crediting the amount charged against the customer in the year in which the sale is made, or that the charges on which the profit is reckoned shall be taken as a proportion of the cost according to the number of installments which have been paid. That is, whenever an installment is paid by the customer, a proportionate like amount of the appliance or whatever it is, shall be charged against the profit and loss account for that particular period. That, I think, is one thing that might be taken into consideration where stoves and other appliances are sold on long-time payments.

H. W. Potter (Burlington, Ia.): We are following the same method practically, as Nashville. The original order signed by the customer is also the shop order that comes back with all the details on it and that is matched against the duplicate in the office so we know all the orders are returned. The original order also acts as a storeroom issuance and the charge then is entered on our merchandise ledger. We do not send bills out immediately after the completion of the order except on cash sales. Where a sale is made on a cash basis and discount allowed, then the bill is immediately mailed. All other charges are entered on the gas bill.

James McGuire (Gloversville, N. Y.): We follow exactly the same plan as Nashville. Our order goes to the storeroom and back to the general sales book. We get our bills into the hands of the purchasers at the earliest possible moment. We type our bills in triplicate to give the collector the exact copy of the bills to work on.

L. E. Sanderson (Rochester, N. Y.): One of the most important things is the adding of merchandise accounts on gas bills. We all should do it.

W. A. Doering (Boston, Mass.): We sort our coupons at night and have them ready to post in the morning. We tried for five or six months to put the gas appliance charges on the same bill with the gas. The result was that the night clerks, and the day clerks, had to segregate the two accounts and they had a hard job. When you stop to consider and figure overpaid accounts, the gas accounts and the gas appliance accounts, they had considerable difficulty in balancing their cash.

J. L. Conover (Newark, N. J.): We operate in offices—some large and some small—therefore we are interested in systems which will fit both. We are experimenting with a system known as "The Continuous or Fanfold." We make up the ledger sheet, customer's bill and the various copies of the orders that go to the shop, at one operation. We have found that getting the bills to customers as soon as possible works to very good advantage.

The ledger sheet, as soon as these forms are made up, is sent to the sundry sales ledger clerk. He holds that sheet in an open file until the completed copy of the order comes back from the shop at which time he inserts that sheet in his ledger, which automatically amounts to taking up the charge against the customer. We have reduced our system to the least amount of red tape, and consider that the continuous system is worth investigating. There is no changing of carbons in order to make your four or five copies. It is automatically

fed and an operator can do twice the amount of work under that system.

J. B. Curran (St. Louis, Mo.): In St. Louis we only sell ranges and gas appliances. They are taken in duplicate and put on the customers' ledger. They are charged on the gas bills each month and the accounts are written up for collection on the collection books along with the gas bills.

H. F. Frey (Allentown, Pa.): Mr. Conover, what do you do where a fitter goes out to do certain connecting work where the material may not all be needed or part of the work is not completed? Does that fitter make the change in the amount of the bill and report that to the office, or not?

J. L. Conover (Newark, N. J.): In a case where the cost is not known, the bill is held by the sundry sales ledger clerk until the installation is made. Then the correction is made on the bill and the bill mailed.

H. F. Frey (Allentown, Pa.): What do you do in the event of small items, such as mantles, where the customer orders two and one is not needed?

J. L. Conover (Newark, N. J.): He would bring the bill back.

H. W. Douglas (Ann Arbor, Michigan): May I ask for arguments against putting the merchandise on the gas bill?

H. W. Potter (Burlington, Ia.): Where the merchandise is not put on the gas bills, eight per cent of the merchandise bills are not paid.

McMan (Boston, Mass.): I have got to disagree with Mr. Doering. We did carry the amount forward to the gas bill and at that time I was very much against it because we did not have the proper equipment to segregate these bills. But during my travels around the country in the last two weeks, I have been sold with the idea of having it on the gas bills. Other companies have been successful in doing that. There are companies that are making out separate bills, but I believe a very large percentage of merchandise bills will be paid if they are added to the gas bills.

W. H. German (Harrisburg, Pa.): A few years back we thought our billing could be done by eight clerks. We originated "noted" gas bills before we knew what merchandise bills were. When the merchandise business opened up, we added that notation with it. We noted the full amount of the bill; our supposition being that it would show to the consumer, the balance of his account as shown on our books. We found in our experience that it would not work out satisfactorily, particularly on the installment sales.

M. D. McQuade (Washington, D. C.): We used to charge small amounts on our bills and we found we had a good many complaints, so we stopped that and do not charge anything under five dollars. We also find that in transferring in lead pencil to the gas ledger from the appliance ledger, the amounts which are paid on installments are paid regularly each month so that the money comes in with the regular bill. In that way we get our money in quicker. We find that we have had great success in billing our appliances on our bills on separate coupons.

James Maguire (Gloversville, N. Y.): I am very much opposed to putting merchandise on gas or electric bills.

Member (New Haven, Conn.): I am very much opposed to putting merchandise on gas bills because it delays the sending out of the bills. It is very de-

sirable to have the gas bill get to the customer as quickly as possible after the meter-reading, so there will not be a great lapse of time between the date of meter-reading and the presentation of the bill. I also agree with Mr. Doering that it makes it more difficult to get the credits on the merchandise separated from the credits on the gas bills.

A. F. Short (Providence R. I.): It seems to be the most natural thing in the world to put the merchandise account on the gas bill. It seems to me when a man has a bill showing that he owes the gas company money for gas or other things, he would rather pay one check and have the thing cleaned up. That is especially true of installments where they run along for say six months or a year. They pay the installment every month. It does not seem to be business-like to send two bills.

W. H. Cassell (Baltimore, Md.): What are the arguments in favor of not putting the charges on the service bill? In Baltimore, we went into the appliance business in 1903 before the consolidation. We started immediately putting merchandise on service bills and we never had any trouble. Once in a while somebody would want to discount the gas bill so we take it off without any protest. We should put our business on a straight merchandising plan and work the department store scheme of putting all the items on one bill. That is what we attempt to do. Mr. Doering has seen that done without any difficulty at Baltimore and I do not understand why he apparently believes we can not do it.

H. C. Davidson (New York, N. Y.): We are so organized that that is a department I do not come in contact with. My recollection is that we do put them on. Personally I think it is a logical thing to do and as a consumer, I would like that way best.

C. A. Conard (Philadelphia, Pa.): May I ask Mr. Cassell what percentage of those that they add to the gas bills are not paid at the time the gas bill is paid?

W. H. Cassell (Baltimore, Md.): I think the percentage would be hard to figure, but the cases are very rare where they make a demand for the elimination of the installment. If they make such a demand, it is usually a case of not being able to pay that month's installment for financial reasons.

C. A. Conard (Philadelphia, Pa.): I can readily see that there would be no objection to having the amount put on the bill, but if we could form some idea of the percentage of bills that were not paid, either by those coming into the office or those that would send a check for the gas bill alone, we would have some basis to work on. Now if the amount should run twenty-five or thirty per cent that do not pay the installments with the gas bill, I think it is very foolish to put them on.

The Chairman: If they can collect seventy-five percent, it certainly pays. Do you not think so, Mr. Cassell?

W. H. Cassell (Baltimore, Md.): That is the way we feel down in Baltimore.

Ewald Haase (Milwaukee, Wis.): Milwaukee does it. They have signed contracts to pay in installments on the gas bill.

H. F. Frey (Allentown, Pa.): Our consumers get their bills for gas within two days from the date we read the meters. We do have merchandise accounts and none of the bills are delayed longer than ten minutes.

Homer Pace (Charleston, S. C.): I have been going around the country for a number of years in big cities and small cities, and you see them in their advertising today say that gas ranges can be paid for on installments added to the gas bills. I have had occasion recently to investigate this condition in three or four of the southern states. We found that nine per cent of the smaller companies find that practice preferable. We do it and we would not discontinue it for any reason. Our collections have increased about eighty percent by adding the installments to the gas bills.

DeWitt Clinton (Worcester, Mass.): I cannot help but think: Where would the gentleman's collections be increased eighty per cent by putting them on the gas bills? What I wanted to say was that I do not believe Mr. Doering has any standing in this court at all. He not only will not put his merchandise bills on his gas bills, but the finger of scorn should be pointed to that gentleman because he works in night shifts in order to keep his books up. He admits it and I am from Massachusetts and am ashamed of him.

W. A. Doering (Boston, Mass.): One argument against putting merchandise charges on the gas bills is because of the limited space for entering these items. The average gas bill is too large in size of the paper. In reducing ours recently we had to cut down the printing on it and rearrange some of our billing systems.

It is all right if a person buys a gas range and you put down "Merchandise —five dollars," but that same party probably has purchased a Radiant Fire. The chances are they will want those itemized. The collector wants to make a showing when he returns to the office, so he says, "Pay me the gas account now and I will cross this off for the time being, and the next time I will let you know what it is." He cannot explain it and the person will not pay unless he knows what he is paying for. While we do not put them right on the gas bill, they go out simultaneosuly with the gas bill on a different form which gives all the details.

R. D. Washburn (Boston, Mass.): We find in one of our companies that the most advantageous way is to send out our gas bills on which we also show the merchandise account due, and that it works well to send a statement the first time showing the material, and after that only the merchandise balance needs to be brought in the statement. Once having been rendered, you can refer back to that and that will answer Mr. Doering's question. We are strongly in favor of it; it does bring in the accounts and it gives the cashier, in receiving a bill, a chance to ask if they do not want to pay something on the merchandise, if they have not done that already.

Robert Davey (Jackson, Mich.): I have heard this splendid array of talent on this question and I must admit that I have not decided which way I like best. There is one point on which I would like to get a little more information. Are most of the representatives who have been discussing this question, sending their gas bills out on regular discount days or have any of them adopted what is called the "Continuous reading and discount system," that is, sending bills out every day? If so, what method do you use with appliance bills with that system?

H. F. Frey (Allentown, Pa.): If the bill covers merchandise sales, it is mailed to the customer about two days after the completion of the work, some-

times the next day. It is an itemized statement and any subsequent gas bills that go out show the amount payable at that time. It never causes us any delay or confusion.

W. G. Murfit (Newtown, Pa.): In the first place, posting is saved by putting the merchandise account on the gas bill. In the second place, there are a number of consumers who do not have checking accounts and they appreciate it very much if they can pay everything at once. We have twenty-five hundred meters in our territory, forty miles by twenty-six. A great number of our consumers do not get to our office. It is a good point of service to be able to pay their merchandise bill with their gas bill.

We have continuous reading. We read our meters and leave the bill and collect the money at the same time. We put on the old index at the same time, the reader makes a subtraction (he has a rate sheet) and puts down the amount of money and collects the whole business and we get 70% of our cash in at the time we read the meters.

O. F. Price (Quincy, Mass.): We are not adding merchandise on the bills.

C. M. Finegan (St. Joseph, Mo.): May I ask what is done with merchandise bills on prepayment meters?

McMan (Boston, Mass.): We have prepayment meters and these bills are billed by the prepayment collector when he delivers the prepaymnt bills.

O. F. Price (Quincy, Mass.): I would like to ask the gentleman if the merchandise accounts are filed geographically or alphabetically?

The Chairman: I would answer that they are filed alphabetically.

W. J. Wilckins (New York, N. Y.): In case a monthly installment has been passed, is that past installment added to the next month and you have two months' installments on one bill?

The Chairman: Yes, Mr. Wilckins.

DISCUSSION

(Bookkeeping Without Books)

R. D. Washburn (Boston, Mass.): If any of the companies who have adopted this system have prepayment meters, can they tell me how that is handled? I have given the subject quite a bit of consideration, and that is the principal reason I am here at the convention. But I have been wondering in my mind how in case of prepayment meters, whether they attempt to carry any record, or do they depend entirely on their meter-reading books?

The Chairman: I would answer for Philadelphia. About 50% of the 421.000 meters are prepayment. We intend to bookkeep those meters without books. On the other hand, there is Mr. Price of Massachusetts, who has a system which he is preparing to inaugurate the first of the coming year.

O. F. Price (Quincy, Mass.): We are not setting any prepayment meters at the present time. In fact, we are reducing them very fast. We intend to keep a card record of all prepayment meters which will contain the address and number of meters and ledger accounts. The prepayment sheets will be approximately the same with the exception of the amount collected. The tabu-

lation and the amount-of-revenue-taken-in sheet will be the same. In order to have a check on it, it is necessary to keep track of the number of sheets in each meter reader's book, so that he cannot maliciously destroy a sheet and lose all records. We have not put the system in as yet. We are going over to the first of the year. But there is no question that if it works properly it is a great saving in money.

I would like to ask if there are any companies who are adopting it that are in the same position that we are and have no discount?

W. H. Cassell (Baltimore, Md.): Where they do not have a discount system they do have a due-date which practically takes the place of the discount period.

The Chairman: What he means is where they do not discount at all.

W. H. Cassell (Baltimore, Md.): We have found that 85% of our customers paid on or before the due-date, and we figured what was the use of keeping a detailed record of those people?

The Chairman: It operates better where there is a discount or penalty.

W. N. Porter (Philadelphia, Pa.): The United Gas Improvement Company always maintained that the bound ledger was the only system. We tried several systems of loose-leaf ledgers but we were never satisfied with the results. One reason was that our ledger clerks could not keep the same number of meters with the loose-leaf systems as they could under the bound ones.

In 1917 we adopted the People's Gas Light & Coke Company's loose-leaf system, and put it in three of our companies. We were not satisfied with the results. I merely mention that to show you that we were not prejudiced against any other system.

When the Baltimore system was originated, I wanted to investigate that system. We sent several men down there to investigate it and not to spend a day, but a week or two weeks. We wanted to see if the system would give the same service to the consumers that our bound ledgers were doing, and we also wanted to see if the accounts could be audited with the same degree of accuracy. We also wanted to see if it was worth while to put it in, even if it was not more economical. We finally decided that it was worth while and we established it in the office that you have heard about.

I heard about this system, I heard it discussed and I read about it, but it did not impress me so much until I saw it in operation. I think that the installation of this system in our local office is the most economical saving we have ever made in any of our accounting aims. You may not get the same results in the economy of the system as we do; I do not know how it will compare with discontinuing loose-leaf ledgers, but with the bound ledgers we are saving in some places about $40 a thousand meters per year. You can multiply that by the number of meters you have in service and it will give you an idea of what you would save.

Regarding its advantages: We find we get better results in the combination plant. With the bound ledger we were never able to bill a combination bill. It was surprising to learn how we were criticized by the public for not getting out a combination bill—having the gas and electric on the same bill. In a combination plant, if you have 10,000 gas accounts and 10,000 electric accounts,

you have got to have 20,000 addressograph plates. With this system you have only got to have 10,000. You do not have to balance your ledgers separately—you balance them as a whole. You do not keep your receipts separate as to electric or gas. As far as auditing is concerned, we find it is costing us less than under our old system. We do not have to hire such high-class accountants.

We have just installed in Sioux City, Iowa, a combination plant. We made the whole transfer in three months—28,000 accounts. Another saving we make is the cost of bound ledgers, which was a big item and particularly so since the war. The cost of transferring was a big item and that is all eliminated. I think I am pretty well sold on the idea until something better comes up.

A. G. Branat (Newark, N. J.): I would like to ask Mr. Porter to give us some information in regard to verification by this system.

W. N. Porter (Philadelphia, Pa.): You check the reading on the route sheets and if you wanted to prove any month's sales or six months' sales, you would verify the reading on the office copy of your bill with the route sheets.

A. G. Branat (Newark, N. J.): When we cross-foot a ledger, sometimes we pick up an error of ten thousand feet. I was wondering if you could pick up any errors.

W. N. Porter (Philadelphia, Pa.): It is almost impossible to make an error in over-reading or under-reading the way we outline our work. The route sheet shows the reading. Now the meter reader makes the deduction at the time he reads the meter. The idea is if he did not make the deduction he might make an error in reading the meter. He catches an error in the consumption by having the previous reading to guide him. Now if he does not catch it, the girl who typewrites the bills, who puts in the reading, and the machine doing the subtractions automatically gets a certain figure, she has a figure shown on the bill to compare with the figure on the route sheets, and to catch any over-rating or under-rating.

William F. Boyd (Philadelphia, Pa.): I just finished auditing a company and found quite a number of mistakes in subtraction. That was, I checked all subtractions for one month and the way those errors happened was that certain meter readers put down figures which were indistinct. A three would be taken for a five one month and taken for a three the following month, making an under-charge or an over-charge of twenty cents or $2.00, as the case might be. But that would be shown simply by checking the subtractions on the route book.

J. D. Scott (Wilmington, Del.): I notice that Nashville saves $5,000 a year. I presume that must be on the basis that they save more than $40 a thousand meters.

D. L. Bosworth (Nashville, Tenn.): We save more than $40. At the convention last year, I am frank to say that I did not like this system. But Mr. Porter was able to convince me on every question and the more I got into it the better I liked it. We started changing in January and took four months to put it in operation. We think there is nothing else like it and I may add that where you have women in the office you will find the system is very beneficial because it can be worked out to a point where it is almost automatic.

We do not detach the office coupon before merchandise payments are put on and in putting those payments on the gas bills we have a stamp-mark on the office coupon—"See merchandise"—because a great many people come in with the duplicate bill and will not get that merchandise payment on it. We have about 12,500 meters, and we are handling all that with three clerks—two ladies and one man.

We have had very few errors and have been able every month to balance those accounts with the general ledger. Apparently all that have put in these systems have made some few changes. We have some changes on the revenue and posting. We do our posting daily. Everything collected one day is posted the next day, and on all meters read one day the bills are mailed the next day. We balance, say today, all the routes that are going to be read tomorrow. At the end of the month we take a balance on all our other accounts. I think it is a good idea to know that you can balance at all times. You do not have to go back to the previous month's work and dig up things. We would not go back to our former system for anything.

H. F. Frey (Allentown, Pa.): We have had it about two years. In regard to Mr. Price's question in reference to a discount date, I have never had any experience in a situation of that kind. But our discount date now is ten days after delivery of bill and the day following is what we term our balancing date because the majority of the bills have been paid. In your case you may not get the money in quite as quickly as we do, but you will get it long before you are going to send out the next bills. Instead of making the balancing date the fifteenth or twentieth, I would make it the date that you feel the majority of bills are going to be paid.

In reference to cross-footings, that the gentleman spoke about, to my mind that is as simple in this system as it is in bound ledgers. The Philadelphia company states that this system makes delinquent customers difficult to handle, because there is more time in obtaining all information. I do not see where there can be any difficulty. Your handbook is in your office containing as much information as the ledger does, excepting dollars and cents. You know your rates and you can easily compute them. Of course, if somebody wants a statement covering a period and the dates paid, it is not as convenient as the ledgers. We have 23,000 accounts on this system. Excluding supervisors or consumer-accounting, which includes meter readers and various things of that kind, there are three people operating that system so far as the inner office work is concerned.

We did not affect any saving during the year when we installed the system. We were afraid of it and put in a lot of safeguards which we had no reason to do. We did not increase our cost but we did retain our entire force during that year—1921. Our expenditure during that year was $51,000 on total commercial office accounts. In 1922 the total amount expended was $47,000. In 1923 it will be $45,000—actual nine months and three months estimated on a very liberal basis. That expenditure in 1923 gives approximately 12% decrease in cost with an increase of meters of 2,663 or about 10%.

It is very simple to convert your present accounts to this system. It does not entail nearly the amount of work that it does to make one transfer of ledgers with the other method.

W. H. Barton (Portland, Ore.): Each man naturally thinks that his own sys-

tem is the best, and I will not try to disillusion these men who are so happy with Bookkeeping Without Books, as I do not feel competent to make a comparison offhand. I think that the meter-reading book is a factor. With you people who keep books without books, your meter-reading medium is almost the ledger because you make the subtraction, and that with the stub you file away. I can not see a great deal of difference in my system, providing you form the ledger and bill at one time, which can be done with the later Burroughs machines. I am going down to Baltimore without any preconceived notions and I am going to learn everything I can learn about it. If it is better than I have, I want it.

The Chairman: That is the way we all felt, Mr. Barton. The biggest pessimists were in this section three or four years ago when the system was first described.

The next order of business was the report of the Committee on State Representatives and Contributions to the Monthly.

REPORT OF THE COMMITTEE ON STATE REPRESENTATIVES AND CONTRIBUTIONS TO THE MONTHLY

James Lawrence, *Chairman*, New York, N. Y.

The Chairman would report the organization of the Committee on State Representations at the beginning of the year.

Practically no requests for information have come to the committee during the past year, such requests as have been presented to the Association having been handled by the headquarters staff.

It is felt that the members of the Association have not availed themselves of the services of this committee to the extent to which they might, and attention is directed to the fact that this committee is designed primarily to represent "service" to the Association membership.

In respect to "Contributions to Monthly" it is our belief that the articles appearing this year have been unusually valuable and instructive to the fraternity.

For this we are indebted to those gentlemen who have given of their thought, their time and themselves, and especially to the Secretary of the Section, Mr. Hartman, who at all times has shouldered the large part of the work.

For the record, a list of articles appearing under the Accounting Section in the Monthly during the past year is appended hereto.

November, 1922 — Fixed Property Records by P. H. Myers, Asst. Director, Bureau of Commercial Economics, Inc., Chicago, Ill.

December, 1922—The Importance of Accounting in Rate Cases by A. W. Teele of Patterson, Teele & Dennis, New York City.

January, 1923—The Uniform Classification of Accounts in Relation to State Commission Requirements by George C. Mathews, Statistician Railroad Commission of Wisconsin.

February, 1923—To Insure or not to Insure by A. J. Metzel, United Gas Improvement Co., Philadelphia, Pa.

March, 1923—Committee on Relations with Customers by A. L. Tossell, Chairman, The Peoples Gas Light & Coke Company, Chicago, Ill.

April, 1923—*What some Companies are doing to gain the Customer's Good Will by Louis Stoecker, Traveling Auditor, Public Service Gas Co., Newark, N. J.

May, 1923—Accounts Payable & Purchases by R. S. Holden, Asst. Director, Bureau of Commercial Economics, Chicago, Ill.

June, 1923—†The Value of the Right Personnel in Customer Service by Louis Stoecker, Traveling Auditor, Public Service Gas Co., Newark, N. J.

July, 1923—**Promoting Good Will through the Order-taking Dept., by Louis Stoecker.

August, 1923—The Accounting Section and the Committee on "Relations with Customers" by DeWitt Clinton, Treas., Worcester Gas Light Co., Worcester, Mass.

Machine Billing & Bookkeeping as in Force at Portland Gas & Coke Co. by W. M. H. Barton, Portland Gas & Coke Co., Portland, Ore.

September, 1923—Operating Budget by Edward Porter, The United Gas Improvement Co., Philadelphia, Pa.

October, 1923—Cash Budget by George E. McKana, The Peoples Gas Light & Coke Co., Chicago, Ill.

(Upon motion made, seconded and carried the report was accepted.)

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*First of a series dealing with the relations of company and customer.
†Second of a series dealing with the relations of company and customer.
**Third of a series dealing with the relations of company and customer.

James Lawrence (New York, N. Y.): Mr. Heins, I would like to say a few words to you, sir, and therefore I am going to ask Mr. Sauer, the Vice-Chairman, to occupy the Chair. (Action taken)

From the time that this Association meeting was called to order on Tuesday afternoon, the program has been full of most profitable things, beginning with the report of the Exhibition Committee and so on through the report of the Committee on Relations with Customers, the Budget Committee, the Insurance Committee, the Uniform Classification of Accounts Committee, the report of Fixed Capital Records Committee, the report of the Customers' Accounting Committee. There has not been a thing in these reports that has not been of profit and benefit to the representatives of the companies in this section.

Last year we heard a good deal about your coming from that ancient Quaker City of Philadelphia where everything was slow and everything was behind time. I am going to suggest that our good Brother Brundage go down to Philadelphia and find that tonic or whatever it may be that they have been feeding and giving to Philadelphians during this past year, for surely you have made a record which your successors will have to work hard to emulate.

You have been a presiding officer of fairness, tact, and yet firm. You have held the meeting together in most excellent shape. There have been no dull moments in the meetings of this section. And speaking for the members of this section, I want to say to you, sir, that we, each one of us, appreciate the efforts that you have given to this work during the past year. We know that this program could not have been put on in the way it has been put on had it not been for your untiring efforts and therefore,

Mr. Chairman, I wish to move at this time a vote of thanks of this section to our retiring chairman, Mr. J. W. Heins, of Philadelphia.

(A rising vote of thanks was given Mr. Heins.)

The Chairman: It has been a great pleasure, Mr. Lawrence and gentlemen, to have been the Chairman of this section. We have had nothing but pleasant relations all of the year. All of you, the chairmen and the members of the committees are entirely responsible for the success of this convention. I take this opportunity to again thank you publicly and to acknowledge my indebtedness to all of you for the success that has been attained.

W. A. Sauer: Mr. Brundage, may we call on you for a few closing remarks?

H. M. Brundage (New York, N. Y.): During the course of the afternoon, particularly when our newly elected President was in the room, I was tempted to explode a little bit and live up to my reputation which seems to be established in this section.

You will recall that he said this section was one of the real live sections of the convention. He repeated it several times. I have heard it before and so have you. We have had spirited discussion on everything worthwhile discussing. That is a good reputation to get and if in the getting of it, I have been a little factor that helped in a small way to stir up this spirit of discussion and get you on your feet to disagree with my friend Doering, it was all done in good part because it got other men on their feet and certainly we have lived up to our reputation during this convention which is now closing.

Now two thoughts came to my mind this afternoon. They are not to be discussed now. I am giving them to you for what they are worth. Think them over during the year so you may decide what to do with them next year.

First: I want to say a brief word about the adoption of the National Classification of Accounts for gas companies. I want to tell you you are not doing your full duty by the classification. I do not know the exact figures that have been thus far adopted, but there are quite a number who are not giving it the proper attention. During the last two years, gentlemen, I have travelled around a great deal and attended commissions and appeared before state associations and sat at round-table conferences and tried to get this thing established, and have had a substantial degree of success. But I charge you to your face that we have had more trouble trying to convince our own people of what ought to be done than we have ever had with any commission that I ever appeared before.

The trouble is with our own ranks, and that leads you to conclude that accountants as a class are about the smallest body of people that you deal with, and I am one of them. They will sit around a table and argue and debate and rare and tear and pound the table, and if necessary swear as to whether a figure ought to be in red or black, or whether to carry a balance down in red ink or pencil. They will spend hours and hours over immaterial and inconsequential things until you become tired and weary of that miniature detail stuff that does not get you anywhere and you say, "What's the use?"

But just be reasonable. Here is a national classification adopted by the commissioners of all states in the Union.

Necessarily, it is a matter of compromise. There are things in it that I do not like, there are things that I roared about, that I fought with the commissioners' committee about, but nevertheless that was the combined judgment of the organization and it was finally adopted and it has been put in in some fifteen, eighteen or twenty states.

Now there are quite a number who have not adopted it, largely because you accountants have not taken it up in your state organizations or through the medium of direct contact with the Public Service Commission. Will you not, during the year, bury a little personal prejudice and try to get back of this National Classification system that the commissioners all recognize and realize has got to come sooner or later and are only holding off due to this dissension among our own ranks.

Now the second thing is this: If it was not the last hour of the convention I would like very much to start something on this fixed capital matter. I think it was Josh Billings who once said, "The great trouble with the American people is that so many of us know so many things that ain't so." And so this whole story of this attempt, (and only an attempt it is), to keep a continuous inventory of their fixed capital, is to me very fallacious and gets you nowhere. It is only leading you into a labyrinth from which you will be unable to extricate yourselves in the years to come.

Two years ago this thing was brought up before this convention and discussed in the meeting, and I voted for the establishment of a committee to have them study it because I was looking for light.

That first year before the convention closed, I was satisfied that such a record as they were talking about and as I had in mind too was not possible.

Then my mind turned to the thought, "Let's have an engineering record, a purely statistical record, similar to what you had for production cost or original cost, for the purpose of obtaining information." The more I studied that the more I became convinced that that was not feasible. I want you to think this over between now and next meeting and see if you do not come to the same conclusion as I have and some of the gentlemen who have tried to work it out. You will spend immense sums of money to get a result which in the final analysis is going to be inaccurate. And ten years from now, after you have operated your elaborate accounting cost system, you will have results in points of cost of different units of plant and equipment that are no longer there but have been moved somewhere else.

Just consider the matter of piping for any good-sized plant. Consider the matter of yard connections. There is no foreman in any plant who does not shift those things around. A plant is growing continuously and he runs a pipe across that end of the plant and later you put in a generator and without further authority he decides to move the pipe over there because it is more convenient. And you have got a record of thirty-six feet of four-inch steam line that goes somewhere, has been moved somewhere else, and probably the cost is buried in your operating expenses for repairs. When you get to this question of keeping a detailed record or detailed inventory of every piece of fixed capital that you own, you are chasing a rainbow in my judgment, gentlemen, and are only guessing. There are not more than ten or twelve companies represented in this room today who have the means to go into that elaborate system and the rest

of you gentlemen are not interested because it is too expensive. The companies that can afford it ought not to afford it because they are going to get something they can never use.

FINAL ADJOURNMENT.

MINUTES OF THE COMMERCIAL SECTION

FIRST SESSION

Tuesday Afternoon, October 16, 1923

The first session of the Commercial Section was called to order by the Chairman, Mr. Wm. Gould, the attendance being approximately 400 members and guests.

(During the reading of the Chairman's Address, Mr. J. E. Davies, Vice-Chairman, assumed the chair.)

ADDRESS OF THE CHAIRMAN

William Gould, Boston, Mass.

During the past twelve months and since our last convention, our gas company members have made records in their sales of gas and appliances. I feel that our Commercial Section has been one of the great helpful influences in bringing this about and this places us in a position to take unto ourselves increased enthusiasm and interest in the work to be done during the coming year.

Your committees should feel proud of themselves and the Association proud of them, as they have continually functioned and worked during the past twelve months, as will be shown by the several reports from their chairmen. One has only to look over the sales results of all our company members to prove this statement.

I wish at this time to thank, for our Section, your Vice-Chairman, Mr. J. E. Davies and Mr. J. P. Hanlan, who have been in charge of the Sales Stimulation Committee for the past year. This committee has sent out pamphlets containing constructive and helpful sales suggestions covering the different seasons of the entire year to all our company members. They have been untiring in their work. They have, to my mind, offered the best sales suggestions ever put out by our Association.

Another important committee which has helped to put over the selling idea and whose work has even been more difficult than that of the Sales Stimulation Committee is the Committee on Co-operation with the Plumber and Heating Dealer of which Mr. F. H. Knapp has been chairman. Mr. Knapp has personally addressed several conventions of plumbers and the impressions that he has left with them are those which will help the plumber and heating dealer to have more interest in the sales of gas appliances, and which will tend to reduce their antagonism to gas companies. This is a most important step taken along the line of proper public relations, as it most certainly tends to reduce antago-

nism and substitutes a more kindly feeling among those people coming in contact with the plumber and the heating dealer.

This Committee of Cooperation with the Plumber and Heating Dealer sent out a pamphlet to all company members giving them several suggestions for cooperation with the plumber and dealer that were in such form that they met nearly every local condition that could exist in any gas company. I know personally of many companies who have been influenced to start along the suggestions made by Mr. Knapp's committee and I want to thank Mr. Knapp and his committee for their cooperation, hard work and good results which they have achieved.

The Committee on Home Economics Service Bureau, of which Mr. Philmer Eves is chairman, got out a most comprehensive story regarding this subject, covered in detail with photographs and suggestions, whereby nearly every gas company could profit in the use of them. This subject of Home Economics Service Bureau is closely allied with stimulating proper public relations and also helps in a considerable way to increase the sales of gas appliances, and their proper use. I do not know of a more important committee, for the reasons suggested above, and I trust that their work will be continued.

Mr. A. P. Post was chairman of the Retail Pricing Committee and, whether you know it or not, had his work cut out for him. None of us who listened to his wonderful paper on this subject, before one of the general sessions last year, can forget how thoroughly he proved his assertions. I have appreciated the difficulties in the path of Mr. Post and his committee and a report has been made to your Managing Committee which has been submitted to the Executive Board with definite recommendations. Mr. Post will speak for himself later on this subject but no matter what he says at that time, I wish to thank him and his committee for the recommendations sent in.

The Committee on Cooperation with Architects and Builders, of which Mr. R. S. Doull is chairman has also had a hard row to hoe. They have made considerable progress in bringing before the proper men suggestions affecting our industry and I feel regarding this committee's work in the past and in the future, that because of its importance it necessarily must move slowly.

In reviewing the work of the above mentioned committees and the fine results which they have achieved, I think that they will all agree with me that these would not have been possible except for the cooperation, help and suggestions given to them by our section secretary. It has been a great pleasure for me personally to have had this same kind of cooperation and help from Mr. Stotz during the past year and I think it perfectly proper that at this time I should thank him.

As your chairman I cannot but help make a few suggestions.

First—I would like to recommend that the committees I have mentioned to you be continued during the coming year, as I consider their work of great importance.

Second—I wish to speak to you regarding the Dollar Appliance Sales per Meter per Year Contest and the object in having it.

In every other department of the gas industry but the Sales Department,

standards are set, bogeys are made to aim at. In the accounting, in the operating and in the manufacturing sections, there are certain standards. In our commercial departments we have heretofore worked on a hit or miss plan, doing what we called "as well as we could" and increasing year by year our sales. But when all was said and done we had no definite knowledge or the facts that would prove that we had done well.

This Dollar Sales per Meter per Year Contest was inaugurated with the thought that this section might be able, with the facts gathered, to suggest a bogey or a mark to be reached by the gas companies in the sales of appliances. This contest put all our companies on an even basis, namely "Dollar Sales per Meter," which we felt was a fairer comparison than quoting total sales, which was of little inspiration to small companies. This same comparison might turn out to be favorable to the small company man, if these totals were divided by the number of meters in his territory.

This has proven to be true, as the smaller companies have shown a much larger average in total sales per meter per year than the larger companies. I think this gives the smaller company man a more hopeful feeling than he has ever had before.

It is perfectly obvious, I am sure to you all, that a gas company's total sales of appliances will be much greater if it has 50,000 meters than the company that has 5,000 and instead of talking hereafter of gross sales of appliances, I recommend that we talk in terms of yearly sales per meter.

This is done generally in making comparisons between large and small companies when their sales of gas are discussed, namely, output per meter per year, and I can see no reason why we should not continue to get some facts besides using what we have already received, to bring into existence a goal, a standard, a bogey, or whatever you will have it, for which our sales departments may aim at or strive for. I trust this will be the start toward this custom. Let our Commercial Section not be behind our brother sections, in setting standards. When this has been achieved I sincerely hope that we will go a step further along this line.

I am suggesting that we should know how many actual appliances should be sold yearly for every 1,000 meters. During the past year I have talked with many manufacturers regarding this subject and, in seeking information, was much disappointed, as the figures they submitted to me were based on what they hoped would be sold to meet their manufacturing output, rather than from any definite facts.

If you will bear with me for a minute I would like to give you an illustration. For the sake of argument, agree with me that the conservative life of a range is ten years. Also agree that the gas companies have doubled their customers in the last ten years. Another necessary agreement you will have to make, and it is perhaps exaggerating but on the safe side, allow me to say that ten years ago 50% of our gas customers had gas ranges, which means that for every thousand meters there were 500 ranges installed. If the company with 1,000 meters ten years ago, has in the past ten years doubled their meters, they have now 2,000 meters, 50% of which are ranges, which could mean 1,000 ranges installed.

If ten years is the life of a gas range, conservatively speaking, at the end of this ten-year period 500 of them should have been replaced, which means an average of 50 per year. And if the same percentage is allowed, the 1,000 new meters taken on, that would mean another average of 50 ranges per year or a total of 100 ranges per year should have been sold to take care of the unfit ranges and to live up to the average of 50% on the new meters. Therefore, a company of 2,000 meters today should have sold during the past ten years an average of 100 ranges per year. This, I wish to call most particularly to your attention, would be making no progress, but would merely be taking care of a situation which existed ten years ago. It does not allow for any increase in new business, education and development.

Roughly speaking, this would mean that every company should sell 5% of its total meters in ranges per year or, as expressed above, a company of 2,000 meters should sell 100 ranges per year. Now gentlemen, is this being done in your companies? You know the total number of meters you have, take 5% of them and see if you are selling that number of ranges per year. How many of you know definitely the percentage of ranges to meters installed?

I am sorry to say, by the figures I have already received, that in the majority of cases the gas companies are not selling 5% in ranges of their total meters per year, and this is further borne out by our own experience of 4% last year. But we are satisfied that at the completion of this year we will have made the 5%.

This situation to my mind can best be cared for when we strive to sell an amount of appliances that we all agree should be sold. But as the present custom exists we are all doing the best we can, with no definite goal in mind, and the "best done in the past is not good enough" for the present.

I feel strongly on this question, gentlemen, and think that our section could very well analyze the figures submitted in this Dollar Appliance Sales per Meter Contest and with the figures received from future contests of like character we could definitely set, for our company members, a sales goal to aim at at least and one which, to my mind, would be reached in a very short time. None of you set out for this convention without definite knowledge, plans and determination as to where you were going. You wanted to attend the convention and in order to do that you knew you had to go to Atlantic City. You aimed at some definite point and reached it. This we do in our everyday life and it is perfectly reasonable that we should have some definite goal set in our Commercial Section.

Before closing I have another matter heavy on my mind, as I feel its importance is great. I do not feel that we have paid enough attention to the progress we are making in the efficiencies of our appliances. The uppermost thought in my mind regarding this is the insulated oven on our gas range. I do not need to try to sell the idea that insulation not only keeps out the cold, but keeps in the heat, as this has been proven all over the world where people are efficiently using heat. It is time, gentlemen, to my mind, that our gas ranges and other appliances be improved in their efficiencies. We are using a product which gives heat and we are the only industry selling heat that is behind on this subject of insulation.

There is an insulated oven range being manufactured and sold by a member of

our Association today and it is on exhibition here on this pier. The results that these insulated ovens have given have, in many cases, exceeded the claims made by the manufacturer. I always believe in looking at the good points and trying to make constructive suggestions, and I most earnestly ask your close attention to what I have to say regarding this matter.

I have talked with many manufacturers regarding this subject. Some of them are very much interested, some of them are so interested that they are experimenting along this line. One manufacturer's representative, in whom I have great confidence, told me that at the most, a saving in oven fuel would be from 10 to 25% and that as the oven did not use as much fuel as the top burners why bother about an insulated oven.

Any betterment of our service to our customers and any effort to eliminate wasteful use of our gas by them is basically good business. Perhaps it is not a great reduction in this case, but you will agree with me that it is along the right line, and would be appreciated by our customers.

It has another point of importance to my mind. It is an improvement on the ordinary type of gas oven, therefore is a distinct new selling talk that will interest our customers and attract attention. It will give them definite reasons to believe that we want to make improvements in our service and appliances wherever and whenever we can. And if we only save 10% in the operating of any appliance or a part of it, I consider it worthy of your earnest consideration. It is a step in the right direction. It will give us something new to talk about and will stimulate even a better feeling with our customers by showing them we are anxious to improve our service to them.

Do you not agree with me that wherever heat is used some insulation should go with it? I am not interested in whatever failures have been made in the past regarding an insulated oven, although this argument has been given me many times. It may have been a failure in the past, but it is not a failure at the present time. The insulated oven range is being manufactured, sold and satisfactorily used in this, the present day, and I trust that you will ignore past failures, and at least prove to yourself that an insulated oven range would or would not be an addition to your service.

One more suggestion regarding the gas range before closing. Our gas companies, particularly the smaller ones, have as their greatest competitor the coal range and we are striving to interest our customers to use their gas range twelve months of the year. This would greatly improve the winter months' valleys of output. Let us be perfectly frank in comparing the service given by the gas range and the coal range.

The coal range gives heat for the kitchen, heat for cooking and heat for hot water. Our gas range is built and gives practically one of these, heat for cooking.

We are, therefore, trying to replace a three-way coal range with a one-way gas range and necessarily our progress is slow. How many automobiles would be sold today if they could only be driven north and south, a one-direction car? You and I want an automobile that will run in any direction. Therefore, why would it not be wise to consider building a three-way gas range to compete with the three-way coal range. This, to my mind, might be done by installing in the

regular equipment of a gas range a room heater, together with some type of water heater, each to have its specified work to do.

This is a manufacturing problem, but I do feel that it is possible to build such a range and it would give us a more worthy competitor to the coal range than we have today. It would also minimize sales obstacles and would give to our customers the installation complete to give heat for cooking, for heating hot water and for heating the room. I hope you will give this suggestion your earnest consideration.

While I know you are tired of listening to me, I cannot close without thanking again the gentlemen who have worked with me on the Managing Committee and on the different committees. I wish to thank, at this time, our Secretary-Manager, Col. Fogg, for his many helpful suggestions and for his co-operation.

GAS APPLIANCE SALES PER METER CONTEST

The Chairman announced that the next and a most interesting part of the program would be the presentation, by President R. B. Brown, of the prize awards in the Gas Appliance Sales Per Meter Contest for the twelve months period ended August 31, 1923.

The President: I have always been very much interested in the activities of our commercial men, and have, perhaps, appreciated more than some of the purely engineering staffs of our companies the value to us of these commercial men and their activities.

I have been very much interested in this question of the load factor on our plants in the distribution system for many, many years, and of course early realized that we could not sell gas without appliances, and we could not put those appliances into the homes of the people in the way we wanted them to be put in, without effort, and that that effort, misdirected, would cost a lot of money and get us nowhere.

So my interest in your section is not new or recent.

The work of your Sales Stimulation Committee has been of very great interest to me—I know it has been doing a lot of good not only for our small companies, where perhaps its helpfulness has been the greatest, but for many of our larger companies, and perhaps for all of our larger companies, in some sense or some measure.

We all, particularly in the larger companies where we are organized for that kind of work, have programs, but every little while we see where someone has gone us one better, and we are awfully glad to have those suggestions, because by the incorporation of them in our own programs we perfect them.

Then I have been interested this year in this pet scheme of your chairman, and he has gotten somewhere with it, too—this dollar sales of appliances per meter.

But there, of course, he has bumped up against a very difficult proposition. In our engineering work, which he compares it with, and our appliance and operating results, we have a somewhat simpler and easier proposition in setting

up a mark to shoot at. We know, by data that has been accumulated, that a certain plant, certain equipment, with certain raw materials should get for us, if properly operated, certain results. It is comparatively easy to set a mark to shoot at on that proposition. We know that someone else with a somewhat different plant, perhaps very much less up to date, cannot get those results, and we set a different mark for them to shoot at. But here you have a proposition of setting up a mark that should be reasonably attainable by every one of a thousand companies with almost a thousand different conditions under which to operate.

I will say that I have been very much interested and very much pleased at the way a large number of our smaller companies have gone after this thing, and I have been surprised at the greater leveling out of results in those companies than I had any idea we would get. I thought you would have such a jagged curve that you could not get anywhere, but, as a matter of fact, you are getting closer to it than I thought you would.

It is very interesting to watch the development of that, and having that interest in it, I have been kept as well informed as I could as to where you were coming out. But I did not anticipate that you would get as splendid results as you have gotten.

Of course, I want to give one warning here,—I do not believe that any contest of this kind will prove anything but that strenuous effort has been made, because you take one plant which has never done its duty in the way of selling appliances to its customers in the past, and it would have a wonderful field; and some other plant which has pretty well saturated its customers with appliances would not have that big field. And when you put the same effort on the plant which has not sold appliances in the past as you put on the plant which has sold a lot of them, you are not going to get the same results.

But that is no reason why we should not conduct such a contest and stimulate the efforts of the fellow who has the wonderful field to cultivate. And if he gets better results than some of the rest of us who have been older in the game, all right—we will take off our hats to him.

As to these prizes that have been offered, this is a recognition of an effort, honestly and earnestly made, Mr. Chairman. I understand that you have divided your districts into two general classes, by geographical territory, and in the first class the company which has made the best showing on this arbitrary method of measurement is the Lebanon Gas and Fuel Company, of Lebanon, Pa., with 1,216 meters, showing sales per meter per month of $1.43, which works out to annual sales per meter of $17.16—I should say a very remarkable showing for a company of that size and the character of the population in that town, which I used to know something of.

Second in that northern group is the Emporia Gas Company, of Emporia, Kansas, with $15.36—another very remarkable showing.

As you go down that list you will find that there are seven companies which entered this contest, with over $12.00 annual sales per meter, and most of them are comparatively small companies. I do not know of any reason why that should necessarily be so.

In the Southern Group first place was attained by the Bristol Gas and Electric

Company, of Bristol, Tennessee, with annual sales per meter of $27.60 and second place was awarded to the Winston-Salem Gas Company, Winston-Salem, N. C., with almost an equally good showing, $27.24. In that group there are eleven companies that show above $12.00 annual sales per meter.

(Presentation of Certificates to Winners)

GAS APPLIANCE SALES PER METER CONTEST

For the Period September, 1922 to August, 1923

A tabulation showing the standing of the ten leading companies and their records, followed by the other companies which have reported for the full 12 months' period of the Contest, which latter are indicated in their numerical order and by state location only.

GAS APPLIANCE SALES PER METER CONTEST

12 Months Ending August 31, 1923

Northern Group

No.	Company Address	Meters	Total Sales	Annual Sales Per Meter	Sales Per Meter Per Month
1.	Lebanon Gas and Fuel Company, Lebanon, Pennsylvania	1,216	$ 20,884	$ 17.16	$ 1.43
2.	Emporia Gas Company, Emporia, Kansas	1,050	16,207	15.36	1.28
3.	North Shore Gas Company, Waukegan, Illinois	14,495	211,673	14.64	1.22
4.	Wisconsin Valley Electric Company, Stevens Point, Wisconsin	1,043	14,579	13.92	1.16
5.	Trinidad Electric Transmission, Railway & Gas Company, Trinidad, Colo.	821	10,432	12.60	1.05
6.	Elkhart Gas and Fuel Company, Elkhart, Indiana	5,511	67,897	12.24	1.02
7.	Freeport Gas Company, Freeport, Ill.	5,173	63,047	12.12	1.01
8.	Madison Gas and Electric Company, Madison, Wisconsin	10,633	117,547	11.04	.92
9.	Arlington Gas light Company, Arlington, Mass.	9,189	96,046	10.44	.87
10.	Republic Light, Heat & Power Co., Tonawanda, New York	3,715	37,729	10.08	.84
	Address				
11.	Pennsylvania	10,572	104,248	9.84	.82
12.	Massachusetts	4,187	39,901	9.48	.79
13.	Wisconsin	6,279	59,378	9.36	.78
14.	Michigan	1,336	12,555	9.36	.78
15.	Illinois	11,452	103,632	9.00	.75
16.	Michigan	961	8,516	8.76	.73
17.	Iowa	4,479	39,051	8.64	.72
18.	Massachusetts	567	4,775	8.40	.70
19.	New Jersey	1,526	13,084	8.40	.70
20.	Massachusetts	3,696	31,416	8.40	.70
21.	Massachusetts	1,451	11,679	8.16	.68
22.	Michigan	9,199	76,035	8.16	.68
23.	Pennsylvania	10,236	81,301	7.92	.66
24.	Massachusetts	6,802	63,303	7.80	.65
25.	Massachusetts	4,416	34,315	7.68	.64
26.	Indiana	13,541	105,112	7.68	.64
27.	Massachusetts	2,093	15,964	7.56	.63
28.	New Jersey	8.266	67,788	7.56	.63
29.	Massachusetts	590	4,487	7.56	.63
30.	New Jersey	17,491	128,826	7.32	.61
31.	Maine	15,499	112,843	7.20	.60
32.	New Hampshire	4,550	32,504	7.20	.60
33.	New Jersey	15.549	110,150	6.96	.58
34.	New York	3,722	26,023	6.96	.58

35. Connecticut	24,237	169,714	6.96	.58
36. Utah	14,337	100,090	6.96	.58
37. New Hampshire	1,773	12,300	6.84	.57
38. New Hampshire	5,925	41,111	6.84	.57
39. New Jersey	6,209	42,775	6.84	.57
40. New Jersey	3,639	24,486	6.72	.56
41. Missouri	73,761	492,384	6.60	.55
42. New Hampshire	2,401	15,697	6.48	.54
43. Pennsylvania	24,388	155,733	6.36	.53
44. Michigan	2,160	13,765	6.36	.53
45. New Jersey	8,892	55,255	6.12	.51
46. New York	5,619	34,141	6.00	.50
47. Massachusetts	21,875	129,487	5.88	.49
48. Massachusetts	4,807	28,748	5.88	.49
49. Massachusetts	1,883	11,161	5.88	.49
50. New Jersey	20,259	116,326	5.76	.48
51. New Jersey	12,447	69,042	5.52	.46
52. New Jersey	2,184	12,140	5.52	.46
53. New York	8,865	48,583	5.40	.45
54. Rhode Island	24,046	127,279	5.28	.44
55. Illinois	21,181	112,212	5.28	.44
56. Montana	3,281	17,711	5.28	.44
57. Massachusetts	13,577	73,019	5.28	.44
58. New Jersey	2,695	14,393	5.28	.44
59. Massachusetts	4,027	21,138	5.16	.43
60. Michigan	6,098	31,743	5.16	.43
61. New Jersey	32,289	166,581	5.04	.42
62. Iowa	15,950	81,363	5.04	.42
63. Massachusetts	14,326	84,667	5.04	.42
64. New York	6,767	33,457	4.92	.41
65. South Dakota	5,748	28,322	4.92	.41
66. Massachusetts	1,748	10,490	4.92	.41
67. New York	16,860	82,446	4.80	.40
68. Pennsylvania	1,779	8,388	4.68	.39
69. Pennsylvania	3,243	15,536	4.68	.39
70. Vermont	1,458	6,663	4.56	.38
71. Massachusetts	2,229	9,668	4.32	.36
72. South Dakota	2,823	12,282	4.32	.36
73 New York	24,869	109,998	4.32	.36
74. Wisconsin	3,685	15,752	4.20	.35
75 Michigan	2,022	8,898	4.20	.35
76. Michigan	6,403	27,308	4.20	.35
77. Iowa	29,206	117,889	4.08	.34
78. Connecticut	57,861	236,839	4.08	.34
79. South Dakota	778	3,200	4.08	.34
80. New Jersey	44,093	176,282	3.96	.33
81. Massachusetts	933	3,794	3.96	.33
82. New York	1,469	5,714	3.84	.32
83. New York	4,215	16,248	3.84	.32
84. Massachusetts	890	3,468	3.84	.32
85. Connecticut	3,324	12,750	3.72	.31
86. Indiana	1,781	6,451	3.60	.30
87. New Jersey	2,803	13,313	3.60	.30
88. Illinois	15.718	57,639	3.60	.30
89. New York	46,322	170,176	3.60	.30
90. Vermont	1,415	5,011	3.48	.29
91. Indiana	1,981	6,886	3.36	.28
92. New Jersey	80,609	263,170	3.24	.27
93. Massachusetts	1,258	4,102	3.24	.27
94. Michigan	1,603	5,333	3.24	.27
95. New Jersey	9,171	28,644	3.12	.26
96. Michigan	1,456	4,605	3.12	.26
97. New Jersey	48,951	166,078	3.00	.25
98. Massachusetts	37,140	114,660	3.00	.25
99. New York	1,733	5,364	3.00	.25

100. Maine	8,839	24,582	2.76	.23
101. New Jersey	44,237	121,504	2.64	.22
102. New York	9,251	23,326	2.52	.21
103. Missouri	17,170	40,697	2.28	.19
104. New Jersey	17,243	38,690	2.16	.18
105. Massachusetts	1,894	3,781	1.92	.16
106. Indiana	1,769	3,176	1.68	.14
Total	737,720	$4,006,085		

GAS APPLIANCE SALES PER METER CONTEST

12 Months Ending August 31, 1923

Southern Group

No.	Company Address	Meters	Total Sales	Annual Sales Per Meter	Sales Per Meter Per Month
1.	Bristol Gas and Electric Company, Bristol, Tennessee	939	$ 25,986	$ 27.60	$ 2.30
2.	Winston-Salem Gas Company, Winston-Salem, N. C.	2,056	56,030	27.24	2.27
3.	Orlando Gas Company, Orlando, Florida	1,441	34,525	23.88	1.99
4.	Southern Public Utilities Company, Charlotte, N. C.	4,901	102,246	20.76	1.73
5.	Rocky Mount Public Works, Rocky Mount, N. C.	2,346	47,216	20.04	1.67
6.	Knoxville Gas Company, Knoxville, Tennessee	4,619	82,476	17.76	1.48
7.	Tampa Gas Company, Tampa, Florida	8,616	127,555	14.76	1.23
8.	Roanoke Gas Light Company, Roanoke, Virginia	6,403	92,633	14.40	1.20
9.	Baton Rouge Electric Company, Baton Rouge, La.	2,238	30,623	13.68	1.14
10.	Columbus Electric & Power Co., Columbus, Georgia	2,718	34,239	12.48	1.04
11.	Tennessee	11,953	122,289	10.20	.85
12.	Virginia	942	6,521	6.84	.57
13.	Florida	2,069	13,091	6.24	.52
14.	West Virginia	1,653	9,750	5.88	.49
15.	South Carolina	8,259	47,697	5.64	.47
16.	Georgia	9,631	49,164	5.04	.42
17.	Georgia	4,708	19,505	4.08	.34
18.	Louisiana	56,956	214,872	3.60	.30
	Total	132,448	$1,116,418		

The Chairman: Gentlemen, there are just a few things that I would like to call to your attention in this Appliance Sales per Meter Contest, which I think are remarkable.

We have here some definite figures of sales for the 41 states—33 northern states and 8 southern states. For 106 companies, with over a million meters represented, there has been an average of $5.38 per year sales, per meter, or a total of over $6,000,000.00—an average of $0.45 per meter per month.

I trust that those companies that did not come into this contest, or that came into it and did not follow it out, will put these figures down. You have these pamphlets. Take them home with you and think them over. The southern companies show $8.42 average per meter per year.

I am wondering if the representative of the Lebanon Gas and Fuel Company would give us any specific reason, if he wishes to, as to why he made such a

wonderful showing—if there were any beyond the average circumstances there.

R. W. Uhler (Lebanon, Pa.): I have a few ideas of what we have been doing.

First of all, I want to give credit to the man who deserves most of it—Mr. White.

Our salesmen have been working under what is known as the Doherty Plan of Compensation. They are paid not only for their appliance sales, but also for work such as re-connecting dead service, making service all gas, and getting new service. That has given them something more to work for than just selling appliances. It has also increased our revenue considerably.

We have been running campaigns throughout the year. Those campaigns have proven very successful. I do not recall just how many ranges we have sold, but it has been quite a number.

We also ran a water heater campaign. We set a price on it connected, and permitted a small down payment and per month payments for the balance. We sold in ninety days 154 heaters.

We found another idea that worked out very well was the combination sale, using a gas range and water heater, or a gas range and room heater, or any other combination of two or more appliances at one price, installed, also permitting the part payment on it.

And with all our demonstrations we paid particular attention to having good window displays. Then we had advertising to support all these campaigns. We have worked out an advertising campaign for next year. Practically every day in each of our local papers there will be something by the gas company, thus keeping before the public all the while.

That is about the gist of what we have been doing down there. Of course, we have put in a whole lot of hard work, and the credit goes to the salesmen for that and to Mr. White for his splendid organization and also the cooperation we got from the management, the plant, distribution and service departments. They all worked together to build up the good will which is so necessary. And I challenge you, one and all, for next year.

The Chairman: Well, you thirty-three northern states, what are you going to do next year?

I accept the challenge for the northern companies. Fine! I want to congratulate you. I want to thank you for the suggestions you have given us. They are something definite.

Would the other gentleman like to say something?

Member: All I can say is just to see that each one of the customers is well taken care of, have the service right and sell the appliance so that it will be satisfactorily used.

The next order of business was an address on "Advertising and its Relation to Merchandise Sales" by Mr. William H. Seely, General Sales Manager, The Osburne Co., Newark, N. J. At its conclusion, Mr. Seely was extended a rising vote of thanks.

ADVERTISING AND ITS RELATION TO MERCHANDISE SALES

William H. Seely, General Sales Manager, The Osborne Company, Newark, New Jersey.

Mr. Chairman and men of the American Gas Association, whatever message I bring you to-day—and I hope I may have the germ of some idea that will help—is offered modestly out of my experience. I cannot lay claim to the secret of success. That secret is yours by mail at a few dollars per month at any correspondence school. I am not an orator or a teacher. I came to you with a word which I shall try to make as brief as possible, from one business man to another.

I shall voice no theories. If I seem over-positive in any statements that I make, please accept them as my interpretation of the things that have come to me out of the vicissitudes of fourteen years as an executive in a company whose whole interest in life is the profession of advertising and selling.

The organization of which I am a member during its existence has served almost a million merchants, manufacturers and other business men. I am going to try to tell you some of the things we have learned or that we believe we have learned about merchandising. I hope that you can profit by our experience.

Our company is engaged in the production of Friendly Advertising, in the publication of color pictures and copy. We sell our service to merchants, bankers, small industrial plants, big manufacturers, railroad companies—we number among our clients over four hundred different lines of business, including gas and electric companies.

I tell you this, not as personal or company advertising but to establish a premise from which I may hope to speak with some conviction. Our salesmen circle the globe. They give their time exclusively to our work and come in contact with every conceivable angle of merchandising, retail and wholesale. I want to say that we consider these fine salesmen our greatest asset—that they really are The Osborne Company.

The Product

First of all, in successful merchandising, we must have a real product. In your business you adhere to a certain standard of quality and so we need waste no time in discussing the nature of what you have to sell.

The sale of gas may be a secondary object in practice so far as your gas appliance salesmen are concerned, but it is the primary object in fact.

Having the product, we are ready for action. The fundamental here is the man element. Whatever we plan to do, we cannot get to first base without a real live selling organization.

What Is a Sales Department?

Where does the Sales Department begin and where does it end?

This may sound like story-book stuff, but it is a solemn fact and must be recognized: viz., the Sales Department begins with the officers, directors and general manager and goes right through to the telephone operator, office boy, and every human being, including the gas bill collectors and fitters.

The general manager's sales job consists of giving sympathetic understanding and co-operation to the sales manager. Your sales manager has the hardest job in the company and he must have backing and comradely help from his superiors and associates. There can be no compromising on this question.

The spirit of the team is a mighty factor and the place to generate enthusiasm and good feeling is at the top. That's the only way you can hope to play team ball and team play is the only kind that wins games.

Often we find a corporation where the technical men who head it refuse to give the sales and advertising men the necessary authority and independence of action to carry through. Just as the sales manager should trust the engineering knowledge of his general manager on all questions of production and quality, the sales and advertising departments should be bound only by necessary, fundamental rules of policy and, from that point on, should be given support and freedom of action.

It is essential that your sales and advertising managers should be big men and they should be placed on results-producing bases. If the G. M. cannot trust his sales manager, he should get him a new one, and I would suggest that the sales manager find himself a new general manager if he is unable to get real co-operation and backing from the top. I do not want to be understood here as suggesting rebellion to any man. I merely hold up the vital requisite of thorough understanding and co-operation between general management and sales advertising management.

You have probably heard of the company that was proud of its saving in paying the sales manager only $3,600 per year. When the sales manager died and the new man took the job at a much higher salary, the company figured that instead of $3,600, the late executive had cost $50,000 a year because of the profitable business he failed to get.

I do not want to overdo this question, but to me it is vastly important, this old question of human happiness and personal relationships inside the plant. I heard last week of a three million dollar company where the sales manager and the production manager, occupying neighboring offices and sitting in directors' meetings together, had not spoken for two years with the president sitting on the lid. That kind of a crowd is licked even though they may have prosperity at the moment.

Advertising—The Appropriation and How to Invest It

Now we have a standard product, the potential market exists and we can assume an enthusiastic, forward-looking inside team. Our sales manager is wide awake and out for bear. How is he going to get results?

There is no mysterious answer to that question. He must advertise his wares, of course. And he must have a competent sales force to follow up his advertising.

Advertising appropriations should be definite and the only way they can be definite is to have your appropriation the equivalent of a certain percentage of your previous year's sales. In a small business with proper working capital or in a business that has not grown rapidly enough, the percentage must be larger than in the bigger businesses.

We catch our breath when we read of million dollar advertising contracts, but some of our international advertisers who spend from one million to three million dollars per year are only spending from a fraction of one per cent to not over five per cent of their gross turnover. They have a fixed advertising policy.

But before we make the appropriation, let us see what our gas company wants to do. First of all, you want folks to cook with gas, to use automatic water heaters, etc. You must through advertising get your message to your market. Let us define the market. Then arrange to meet that market. You can do this through newspaper space, billboards and —naturally, I believe this to be the most important—through a unit of friendly advertising delivered by mail or through your meter readers personally at least once a month.

In your advertising plan include some particularly gracious message at Christmas time—a fine, engraved greeting card with a facsimile of the president's signature, or an art calendar, or both. An art calendar should be valuable enough to command wall space and advertise your advertising all year. I like that idea of using a calendar in connection with a general advertising campaign and it does just exactly what I said—hangs before your people and advertises your advertising throughout the year.

Ascertain the cost of doing *all* these things and build your advertising budget to do just as many of them as your board will feel justified in doing.

I am sorry if this sounds like a sales canvass but I cannot build my picture of the way to get results as we see it unless I lay the foundation.

A Sales Force of Real Men Your Most Precious Asset

Awhile ago I said that the most precious asset of The Osborne Company is its sales force, and I want to say that your most precious asset in the gas business must be a sales force of real men. You unquestionably agree with this and I know from contact with the men who represent Public Service Gas Company of New Jersey that their standards are very high. I really believe that I could deliver no more helpful message to you than to refer you to Mr. R. R. Young and Mr. J. P. Hanlan, of Public Service, and to suggest that you study and emulate their merchandising methods.

Advertising seldom closes an order for anything that represents an expenditure which is serious in its relation to the family or business income. You cannot reap the harvest which good, consecutive advertising will sow unless you follow it up unceasingly with real salesmen.

Your composite gas-appliance salesman must have character, personality, human sympathy, domestic understanding. And he must have ambition and be a hard worker.

Ringing Door Bells Must Be a Means to a Fine Career

Your big problem is to get men who are willing to ring doorbells. First of all, you must convince any man who is worth his salt that your business offers

him a career. He must see that ringing doorbells is a means to a very fine end. He must understand that by becoming a member of your sales force, he is going to be able to educate his children, that he is going to be a useful citizen, and that if he sticks to you, he will be one of the five per cent that is not dependent upon charity at sixty.

You must see that he earns a decent income and have him understand that it is possible for him to win advancement in your organization.

My first work in sales management was in a house-to-house business. We had about forty men and they were pretty bad, take them by and large. We worked constantly to raise the standard in that particular organization and, to put hope in their hearts, we let it be known that the four men who made the best showing in a given time would be promoted to district managerships. We compensated these four men in part on a very small percentage of the sales of their crews, but insisted on leadership, personal production at the same time. It resulted in a big increase in business and in much greater enthusiasm among the men.

Supervisors or district managers should be able to set the pace and, at the same time, stir their men to stronger efforts. At no time, however, should the salesman lose sight of the fact that he is working for and in the home office and not working for some field man as an individual.

More Calls Vital to More Business

Getting men to call on everybody, to canvass closely, is vital. More calls mean more business, even if the salesman just rings the bell and tells his reason for being on the doorstep. Do everything you can to stress his idea of making more calls. Interpret it into terms of more business and make your men see that more business means more money for the home folks and a better time in the world for him and his family.

The sales department of the Remington Typewriter Company gave us a real idea some time ago when that big corporation instituted a plan which they still follow of paying five cents for each reported call. The sales manager of the gas company must borrow from other lines of business just as we do in our own company. It will pay you to find some way to reward men who will canvass closely. Folks are folks wherever you find them and merchandising problems are fundamentally the same in most standard lines. People respond to intensive advertising, followed up by intensive canvassing, whether you are selling typewriters or gas ranges.

Logical sales presentation by intelligent, enthusiastic men wins the same response in your work as in mine. If you would have success in your business, you must have a sales force that looks and acts like success and that is capable of doing high grade work. Low grade man material means low grade results.

We are now ready to leave this salesman we have hired and whom we will assume conforms to high standards and has the primary qualifications. I will not dwell at length on how to hire men. I do not pretend to know a great deal about it. I think if I lived another hundred years and could keep on studying, I might learn a little, but there would still be a great deal to learn. It is a vital topic, but it is even more vital that we learn how to keep our men prosperous and happy after they are employed. Sales mortality is a drain on every business and its

prevention and cure are worthy of the attention of every one of us.

How to Employ Salesmen

Just let me say this about employing men: Approach the whole question seriously. When you talk to an applicant, do not exaggerate the good points about the job. Tell your man all about the difficulties he will encounter. It is better for him to know them in advance and, if he is a real man, it is a good way to find it out. Some old boy years ago said that men much preferred to die for a cross than a crown, and I have found that that rule holds good in business. A real man tackles a hard job more cheerfully than one that looks easy. You do not want order takers in your business. Let your man understand you are selecting him because you believe he is man enough to overcome the kind of obstacles that floor many others.

Use a real application blank which gives you all the facts you will need in dealing with your man (assuming that he answers the printed questions honestly and fully).

It will pay you to bond your salesman and to have him fill out a bond application blank when you employ him. Your company should pay for the bond. The bonding companies will sell you a blanket bond for your sales force at a very low figure per man.

I believe that every organization should have a uniform sales contract if it is humanly possible to get one. Hire your men on contract. It shows that you are serious about it and the effect is good all round. Make a contract for at least a year. If you take the job seriously, he will.

The time to begin to cut down salesmen's mortality is when you interview your applicants, and the next period when this looms large is when you begin to coach your new salesmen.

In our experience it is better to try to handle at least three new men together rather than to handle them individually. Give them one thing at a time on which to start. (It cost years and much money to learn this lesson.) Spend a day acquainting these new men with the company, introduce them to some of your officers. Show these salesmen you believe in them and be sure you *do* believe in them!

One Thing at a Time

Your second morning coach them on just one appliance and give them three hours of field selling alone in the afternoon. Then have an hour with them before they go home for the night—an hour of sympathetic discussion of their great adventures of the afternoon.

Repeat this each day for a week or more and you should have better sales starters and lower mortality.

If your sales force is big enough, print a weekly sales bulletin. If you cannot see that, use a stencil bulletin. The printed bulletin is infinitely better. You are able to use half-tones, to publish pictures of sales leaders and prize winners. You give your men pride in their work. See that the prizes you offer are the kind that will interest the folks at home, and when father goes home with his picture in the house sales paper, they are all going to be happy and enthusiastic, and that is going to earn business for you.

We believe that a sales organ should record sales achievements and that your man should be interviewed by the chief as to how certain openings were made, or how certain good orders of the week were closed.

Institutions like the Fuller Brush Company have shown how a great door-to-door sales force can be built up. They have shown how esprit can be introduced into an organization like this. The old prejudice against the "peddler" has been greatly discounted and, through your sales weekly, you can surround your salesmen's work with a quality and a dignity that will be of great value to you.

There Must Be Lofty Men at the Top

Show your men how to be real men. At the risk of preaching, I want to say that the personal standards of the officers of your company and the ideals and standards of your company will be the pattern of the sales force you employ. If you would have real men in your organization, see that they get the right kind of an example in the person of the sales manager and other officers.

Tell your men to be themselves always —to be human and natural and courteous. Do not make them self-centered and self-conscious by having them analyze themselves eternally. Coleman Cox says:

"When a fellow rushes up to you, grabs your hand, crushes your fingers, uses your arm as though it were a pump handle, tries to see just how close he can stand to you, and conversationally effervesces like a bottle of home brew—then, you have met a correspondence school graduate in salesmanship."

That to me is the antithesis of what a man should be.

Tell your men about the problems of their prospects. See that they are able to talk interestingly and convincingly about those problems in language that folks will understand. Pound upon number of calls per day—upon persistence, intelligent sticking.

The Need of "Old Stuff"

What I am saying is old stuff and I know it, but what the world needs today is old stuff in business, in social life and in politics. Stunts, tricks and snappy ideas have jazzed us all ragged. Let us aim for the hearts of the men and women inside the office, in the sales force, and in the homes and business places where our sales must be made.

All this is just one way of saying again that no great sales organization can be built with poor human material. You must employ high grade men and then see that they make money.

Several times I have spoken today of the avoidance of employing low grade man material in your business and the wisdom and importance of hiring real men. Do not misunderstand that. I do not mean that you shall go out and employ a man who *says* he is a high grade man and demands a high salary. Regardless of what a man's antecedents may be, no matter how modest a position he may have filled in the world, look him up and, if he has character, personality, enthusiasm and fight in him, he is worthy of a place in your organization.

In order that your men may make money, it is not necessary to increase the salesman's profit per sale. You must see that they make more sales. To insure them of a real income, you must advertise intensively, work with the men, keep them happy, encourage them and keep ablaze within each of them the fires of enthusiasm and ambition.

Keep Away from the Flippant in Advertising and Selling

Arthur Brisbane says that one picture is worth a million words. We have added to that, "if it is the right picture." That is true whether the picture is drawn

with words or with crayon. Let us give the gas salesman and the gas-consuming public the finest and most convincing pictures of what we are trying to do. Let us try to realize that we are not really selling gas at all. You are selling an even, ever-flowing, dependable fuel to the commercial customer. To the housewife you are delivering one of the big factors in home happiness and, through giving home happiness, you contribute to the business success of the head of the house.

An advertising writer in Printer's Ink says that the line "Yes We Have No Bananas" has a decidedly adverse effect on the banana trade. This may sound far fetched, but to me it is quite plausible. I have a great aversion to the use of smart Aleck copy or flippant language in connection with our business, and I object strenuously to the flippant, smart line being introduced into the relationship between the house and the man in the selling field. This writer in the current issue of Printer's Ink goes on to say that he has personally gone to fruit stores for information and found invariably that banana sales have fallen off. Government statistics which he offers show that there has been a drop of nearly two million bunches in the import of bananas as compared with the previous year. He points to the wonderful result of Sun Kist advertising, bringing California sunshine to the breakfast table, dwelling on the dietetic use of oranges—human, friendly appeal. That little article illustrates the two extremes in advertising as I see them. Naturally, I am not blaming the banana industry for that fool jazz. I am merely giving you the reaction of another advertising man on this question.

As gas men, you have a part through the commercial use of gas in producing thousands of beautiful and useful articles everywhere every day.

Think of the weary women lugging coal hods and ruining their hands with ashes. Put just pride in your hearts and in the hearts of all your organization as you contemplate the revolution being wrought by the gas range.

Take to yourselves the glory of the part gas plays in solving the servant problem.

Think of water being heated automatically!

There is thrill on thrill in your wonderful business.

In Direct Ratio, as You Get the Thrill and Pride and Lift of Your Business and, in Turn, Pass These Human Emotions on to Your Salesmen and to Your Consumer Public Through Promotion and Advertising, Will You Prosper and Build Bigger—That Is the Sole Plank in My Merchandising Platform.

I am not trying to flatter you and your business. What I am saying is sound sense. The gas range is not merely an iron contraption, it is a joy-giving mother-helper. The gas range means less work, it means well-cooked food. It is a cure for indigestion. It eliminates dust and dirt. It means more rest for mother and more recreation time for the whole family. It means having meals on time.

And so we might call the roll. I believe I could write poetry about my own automatic water heater at home—it is such a joy. The same kind of interpretative reasoning can be applied to business men in gas merchandising. Apparent high cost of gas fuel can be interpreted so that the executive sees the real economy of an emergency gas-heated boiler for nights and holidays, for in-

stance. The executive can also be made to see the wisdom of a twenty-four hour hot water supply for summertime in a big plant buying electric power, etc.

In my business, we have succeeded because we have given our lives to dealing with and in human emotions. Everything that has a bearing on our business we pass on down the line, if it is interesting and inspiring. If I pick up something in my travels that has lift in it for me, I feel that it will have lift in it for other Osborne men and I send it along to the office.

I was very much impressed and surprised on going to Paris this summer to see that it is still a gas-lighted city. You do not read about that anywhere. It flashed through my mind as I looked over that most beautiful city in the world, most beautiful by day and by night, that there was a great bit of inspiration for the man in the gas business. That illustrates what I mean.

In our company, instead of starting our advertising and sales appeal with a price inducement and a drab statement of a desire to "sell," we go to the other end of the lane. We demonstrate to folks the happiness and good will engendered by the use of Friendly Advertising. We tell them of our two generations of experience in selling art advertising and point the way for our customers to use one of several proven themes to stir the finest emotions and to have their advertising read under the most favorable conditions.

But I am overstepping the limits of time and if I go on, you will feel, Mr. Chairman, that I am trying to sell you Osborne service.

I hope, as I said early in my discussion, that you will find a germ of something helpful in this attempt to approach the great problem of merchandising. If any of you gentlemen feel that there is anything in my experience that will be helpful to you, I shall be glad to try to answer any specific question about gas advertising, sales contests, or other matters. You have a full program and I suggest that any matter on which you care to question me might be taken up by mail through Mr. Stotz.

The picture I have tried to paint is elemental, but it embraces every problem of your business.

To merchandise successfully you must have a strong, live inside organization—all pulling together, all volunteer members of the advertising and sales departments.

You must reach the homes and offices of your prospects with appealing, direct, friendly advertising.

You must have a well-paid, happy, high-grade sales force. Your sales force must be kept on its toes, cheered, encouraged, entertained and inspired to work hard.

And your company must understand its consumer-public—talk its language, respond to its emotions, be human, sincere and courteous in all its dealings.

Thank you for the privilege of speaking to you. If some of you gentlemen are in Atlantic City early in December, I would like to have you visit the Twentieth Annual Osborne Friendly Advertising Convention and meet a sales force that is made up of high power, trained men who exemplify the business ideals for which my associates and myself are striving and which I have tried to outline for you today.

At this point in the program Mr. E. J.

Stephany occupied the chair while Mr. E. G. de Coriolis presented his paper "How to get Industrial Gas Business." This paper, being a contribution of the Industrial Gas Section, will be found on page 787.

REPORT OF NOMINATING COMMITTEE

The Secretary presented the following report of the Nominating Committee: For Chairman, J. E. Davies, Peoples Gas Stores, Inc., Chicago, Ill.; For Vice-Chairman, J. P. Hanlan, Public Service Gas Co., Newark, N. J.

(Upon motion, duly seconded and carried, the report of the Nominating Committee was accepted and the secretary as instructed thereupon cast one unanimous ballot for the election of the officers as nominated.)

On invitation of the chairman they responded as follows:

J. E. Davies (Chicago, Ill.): Mr. Chairman and fellow members of the American Gas Association: I thank you for the honor that you have conferred upon me at this time.

I believe that every member of the Commercial Section receives as much good out of the section as he puts into it. I know that my association with the Commercial Section during the past two years has done a great deal to help me in my particular field of work. I also know that with your assistance and co-operation, which I must have, because no one man can carry on this work alone during the year, that we will, at the end of 1924, have had a banner year for the Commercial Section of the American Gas Association.

J. P. Hanlan (Newark, N. J.): Mr. Chairman, ladies and gentlemen: Of course, I am happy to be elected as vice-chairman of this section. Any man, I think, would be under similar circumstances.

Speaking of friendly advertising, my friends in the Association have always done that for me, and I hope in return for their confidence in me, as voiced by the Nominating Committee, that insofar as what the vice-chairman may do Mr. Davies' prophecy for a banner year will be borne out.

Our present chairman, as he has done with so many things, set a precedent of having a working vice-chairman.

I will say to you, for those of you who do not know him, that Mr. Davies has been a working vice-chairman. I believe that Mr. Gould is well satisfied, as he has said today, with the support that Mr. Davies gave him, and I believe that this Association has passed on to Mr. Davies a very well-merited reward in advancing him to the chairmanship of this section. There is no doubt in my mind but what Mr. Davies will make you a very fine chairman. He will add credit to the office, such as his predecessors have done.

But I do know that in order to get the fullest benefit from this administration, it is necessary that you, in turn, do your share. There is no question but what the Rotarian motto is just as applicable to this organization as it is to their organization: "He Profits Most Who Serves Best."

Now, gentlemen, let us all see during this coming year if we can all serve our very best, and when we meet in the year

to come, if God permits us all to be together again, I assure you that you will be very, very happy in the results that will have been secured.

The next order of business was a paper, "This House Heating Business," presented by Mr. G. I. Vincent, who was extended a vote of thanks upon the conclusion of the discussion.

THIS HOUSE HEATING BUSINESS

G. I. VINCENT, Manager, Syracuse Lighting Company, New York, N. Y.

FROM A RECENT number of a magazine, which, it is said, is read by ten million people, I quote the following:

"In the near future when gaseous fuel alone is used in our homes, the cellar instead of being a dusty, dirty, wasted space will be as clean as the living room above and will be furnished and used for billiards or even for a more profitable purpose."

But not long ago, a man high up in our industry, whose opinion on any subject would be most valuable, stated informally that unless some means could be found to prevent the use of gas for total house heating the industry would be in a bad way.

In a scholarly rate study, which it has recently been my privilege to read, I note that it is proved beyond question that in a normal, well operated gas company, house heating gas, if sold on a per M basis, would have to bring at least twenty-five per cent (25%) more than the same quantity sold to a customer with a good load factor.

But I am credibly informed that some gas utilities south of the Mason and Dixon line make much of their living upon their house heating load which, obviously, has a much poorer load factor than would obtain in the northern belt.

Surely, we have here enough anomalies to make us wonder whether we know anything about this house heating business. I venture to say that if an intelligent layman studied all our data, he would find himself between the devil and the deep sea and, apparently, the large majority of us engaged in the industry are in little better case.

Now, personally, I do not know very much about house heating. I have never made any experiments to speak of and I have read only very sketchily the profound dissertations which have appeared on the subject from time to time. But I am impressed with the fact that total house heating with gas is in sight from the broad economic standpoint, and it behooves the industry to find out how to take it on in the least bad way. In other words, we are going to get it whether we want it or not, because the differential between the cost of gas and the cost of coal has narrowed to the point where it represents perfectly satisfactory compensation to the user for his less trouble and greater comfort. Do not understand me to mean that we are going to receive a wild rush of applicants for total house heating. The inertia of household activities is very great and even active solicitation and demonstration on the part of gas utilities will probably not yield large numbers of total house heating customers immediately. But in my judgment a slow but certain growth is inevitable and I propose to discuss in a very general way just how the problem had best

be approached and what seems to be a workable solution at the present time.

And just a word in passing about this inertia business. Those of you who are opposed to total house heating had better not count too much on it to prevent its growth. Truly, it has required a generation to bring the gas range from a curiosity to that degree of necessity that a household is scarcely counted decent without it. But total house heating may accelerate very much faster. The greater luxury is obvious. The personal pride of the owner will be an active prod to his neighbors.

It is unnecessary to state that to be permanent in our industry, business must be economical for the customer and profitable for the company. But clearly the profit to the company can not be measured alone by the amount of gas sold and the margin between the burner cost and the selling price. There are other factors and, within limits, some reduction of total consumption by the customer goes hand in hand with increased profit to the utility. Let us pause, therefore, and examine very briefly the rate situation.

To sell gas for house heating on a flat rate, or even a step rate, without suitable protection to the company for its readiness to serve the demand is unwise, both from the standpoint of the company and the customer. It is futile to consider house heating without at least a two-part rate, the first part bearing substantially all the charges that proceed whether any commodity is used or not, and the second part a sliding scale for the commodity. A three-part rate might be even be more desirable but the two-part, as described, will answer. Such a rate would enable the company to be sure of some return and fixed charges on its equipment throughout the year, and enable it to sell the commodity to the customer at a lower price.

Before explaining why less gas consumption for house heating might be better business, both for the customer and the company, there is another phase of the matter that, at first sight, seems to have very little to do with it—that is, dwelling construction and equipment.

The recent admirable house heating number of the *Gas Age-Record* devoted no advertising and scarcely any text to total gas house heating with hot air furnaces. Now, it is a fact that over ninety per cent (90%) of the dwellings in this country are heated with hot air. If, therefore, we desire house heating business and must use hot water or steam, we must make up our minds that we must sell about $2,000 worth of equipment per customer. You will agree with me, I think, that this is hopeless. Our real answer is not even to replace the hot air equipment with a new furnace but to modify and add to the present equipment to make it suitable for highly efficient utilization.

To diverge again, has it ever been your privilege to listen to well-informed architects, builders, and other intelligent people discourse on the subject of house heating? You will probably find that approximately nine out of ten will recommend hot water as being superior to hot air. In fact, in all my inquiries, I have yet to find one who would champion hot air against hot water. Giving a dog a bad name largely accounts for this extraordinary error and has led to most ridiculous assertions. For example, an architect once stated to a group of friends that the reason it was impossible to heat the north rooms on the

second floor of a dwelling with hot air when the wind was blowing was because the wind forced the hot air back into the pipes! Another quaint assertion was that hot water heating was preferable because it humidified the air! I am probably not quoting anything that many of you have not heard before, or, at least, along the same line.

I can give you a number of very good reasons why hot air is superior to hot water. Understand, I hold no brief for any system, but am simply stating facts and you will note later how nicely these facts fit in with our problem.

First—The first cost of hot air heating is lower.

Second—Registers occupy very much less space than radiators.

Third—The air can be automatically humidified.

Fourth—Using a re-circulating system (and nothing else should be considered) continuous partial sterilization of the air is effected by contact with the very hot surfaces.

Fifth—The lag is shorter than any other system, particularly desirable in a changeable climate.

Combine these five reasons with the fact that hot air heating can be just as efficient as hot water and one is hardly justified in considering anything else.

You will observe that I have not touched on one serious objection to the hot air system, which is the furnace gas leakage and dust. This will only be true in coal-fired furnaces and, of course, need not be true if those furnaces are properly built and kept in proper repair. It will not hold with gas heating. The fact that a hot air system does not heat certain rooms under some conditions has nothing to do with the case. It is simply a matter of proper installation. And, moreover, the design I will show you will largely overcome this drawback.

Now, as to dwelling construction. Those of you who have studied the problem are probably well aware of the meagerness of the data available as to heat losses. It is apparent that little attention has been paid to this important matter, except in relatively few cases where usually there was no real scientific foundation. Here again, we find strange prejudices. I recall hearing an intelligent man state that he would not have double windows in a house because it made the house stuffy. He preferred weather strips! There have been brought to my attention cases where house owners have actually been persuaded to discard their storm windows and have weather strips installed in order to save heat loss!

Dwelling house wall construction is also of interest as illustrating adherence to form regardless of what happens. Have you ever heard the assertion that a hollow tile house is the warmest and that a brick house is warmer than a frame house, etc., etc.? Neither of those statements happen to be true for by a mere accident of building evolution the well-built frame dwelling probably has a lower heat loss through the outside wall than any other type. But in any standard type of building wall the heat loss is ridiculously high. Here again, I have made no experiments. We have taken what data we could find and applied it.

Perhaps you do not know of the saving made by the complete installation of double windows. Under average conditions, a dwelling completely equipped with double doors and windows would have sixteen per cent (16%) less heat loss than with single. And this can

be increased to about 20% by other insulation which can be applied without reconstruction.

In a new dwelling, this figure can be nearly doubled with very modest increase in first cost. Figure I shows a cross section of a frame wall construction that is cheap and efficient. Together with double windows and roof or ceiling insulation, it will effect a heat loss saving of about thirty-five per cent (35%). The filling material, which consists of five parts dry pine planer chips, and one part shredded magnesia, is so slow burning as to be practically incombustible.

To the cities where frame construction is not permitted, such a design would obviously not apply. But it is illustrative of the point that better dwelling building from the heat loss standpoint is part of our problem and we should interest ourselves in it.

Before leaving the heat loss discussion, it is well to cover the criticism that such construction would vitiate the air by cutting down the leakage. A whole lot of leakage can be eliminated from the normal dwelling without impairing the quality of the air for wholesome breathing. There will be sufficient leakage for normal purposes and when large crowds are assembled additional ventilation is used anyhow. This is true of bedrooms, also, and brings up another point. In converting a house to gas heating, all preventable heat losses should be studied. For example, fireplaces must have dampers. As bedroom windows are usually open at night, the doors should be well fitted and the openings under doors permanently stopped.

The effect of thus reducing the heat loss is to reduce in exact proportion the maximum gas demand. Truly, it will also reduce the consumption but the maximum demand is a very important item in the cost of carrying total house heating. And without going into details, it can be stated that this reduction in demand will apparently be sufficient compensation to offset the loss in consumption, and both the company and the customer will profit.

And just one further material benefit from reducing heat losses. Drafts in dwellings, particularly floor drafts, are uncomfortable, also a potent cause of diseases of children. Usually drafts are not caused by leakage but by excessive heat loss. Reducing this will reduce the drafts.

From our discussion thus far, the conclusion can be drawn, even if not proved with scientific accuracy, that, given some satisfactory method of modifying present hot air furnace installation, desirable house heating business should be secured. But our installations should include such modifications as might be necessary to reduce the heat loss in the dwelling and, later, the encouragement of better new building. The modification of the heating equipment is the problem which has interested us the most. Figure 2 shows a design which is now being installed and will come into use next winter.

The figure is diagrammatic and represents any form of hot air furnace from which the grates have been removed and gas burners and checker fire brick installed. The latter is for heat storage only and while this storage is but a nominal amount, it will tend to lengthen the lag. A standard heat regulator controlled by a thermostat at some point in the house controls the burners. The design we are using will

have two burners off one header, either or both of which will be lighted from the one pilot. The two burners will be used in the coldest weather and one in the intermediate weather. The balanced valve controlled by the heat regulator will supply gas to the header. The large pilot (about five feet an hour) will be supplied independently.

Air admission to the burners will be worked out to keep the excess air down to the safe minimum. The damper shown closes when the burner is shut off to avoid air by-passing to the chimney and cooling the system. Enough air will be admitted independently to supply the pilot.

Between the furnace outlet and the chimney is installed the economizer, which is to be made of such size that it will take all the available heat out of the products of combustion before discharging to the chimney. To definitely assure this result, a damper on the economizer by-pass is controlled by a thermostat in the chimney inlet. By trial, this thermostat will be set at the lowest temperature at which the chimney will remove the products of combustion.

Difficulty, due to condensation, will be reduced to a minimum because the parts subject to condensation effect will be made of cast iron. The chimney thermostat will be protected in some suitable way. It will probably be necessary to install a drain at the foot of the chimney as shown.

As the basement, with such an installation, will fulfill all the conditions described in the first paragraph of my discussion, it is not necessary to have any cold air return pipes. Those in use can be removed, leaving the opening directly into the basement. Other cold air inlets opening through the floor at strategic points can be made, if necessary. Both the furnace proper and the economizer will then take cold air directly from the base ment and discharge it into the house. How much heat is to be allowed to radiate to the basement will have to be determined by trial. The heating will not be satisfactory if the temperature of the basement is allowed to remain more than 15° F. below the house temperature.

With the addition of the economizer, the average hot air furnace, thus converted from coal to gas, will be a better heating system than it was when using coal. The economizer will discharge a quantity of moderately heated air at some convenient central point while the small pipes on the furnace proper will discharge smaller quantities of higher heated air through the original registers. If the coal furnace did not properly heat with coal, it might be that it will not heat perfectly with gas but, with the proposed design, we can be assured that it will be better with gas than it was with coal, even if it is not one hundred per cent perfect.

Any opening taking cold air from outdoors should be removed and carefully stopped off.

If no satisfactory means of humidifying the air were in the coal furnace, it should be recommended to the customer. There are several automatic systems on the market which can be purchased at a nominal price and which are satisfactory. It should be kept in mind, however, that while a fairly high relative humidity is desirable, it will represent greater heat loss if the leakage is excessive. Some happy medium should therefore be found.

We feel very sure that some modifications to the proposed design will be found after the installation is in use but the fundamentals are sound and it represents a low cost installation that will be fully automatic and very efficient. The device is not patented and we wish that others in the northern belt would try it out so that in another year we can have some cumulative experience.

I cannot close without touching once more on the question of demand and load factor. We can rest assured that the load factor will be better than the pessimists would have us believe. Also, the diversity will affect the demand more favorably than might be anticipated from the nature of the utilization. For example, the production and distribution load factors and the diversified demand of a substantial number of total house heating installations would be rather better than a similar number of instantaneous automatic water heaters used in the summer. They would be about as good as the same number of gas ranges used in the summer only. They would be very, very much better than an equivalent capacity in room heaters used incidentally.

These statements are not made to encourage the solicitation of house heating. It should be clear by this time that this is no part of my discussion. If you believe in it, by all means solicit. If you are dubious, sit tight, but before long you will be put to it to find means to discourage it, and you will not find them. My plea is to establish in your minds a broad practical plan of procedure along all angles of the problem.

We believe the plan I have outlined is the most practical.

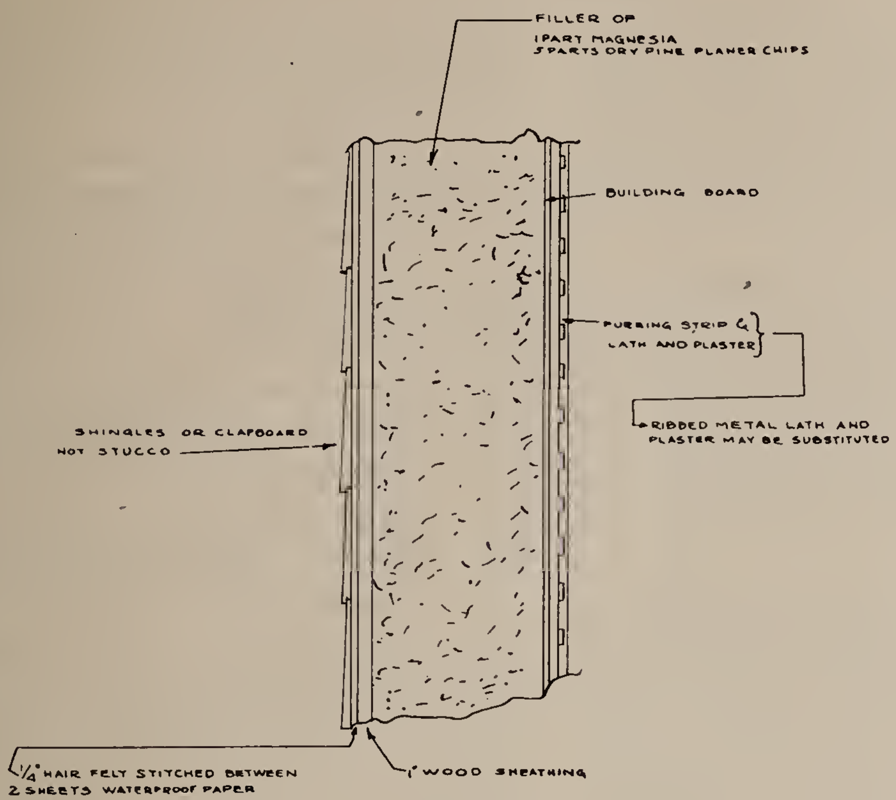
FILLER OF
1 PART MAGNESIA
5 PARTS DRY PINE PLANER CHIPS
BUILDING BOARD
FURRING STRIP & LATH AND PLASTER
RIBBED METAL LATH AND PLASTER MAY BE SUBSTITUTED
SHINGLES OR CLAPBOARD NOT STUCCO
1/4" HAIR FELT STITCHED BETWEEN 2 SHEETS WATERPROOF PAPER
1" WOOD SHEATHING

FIG. 1

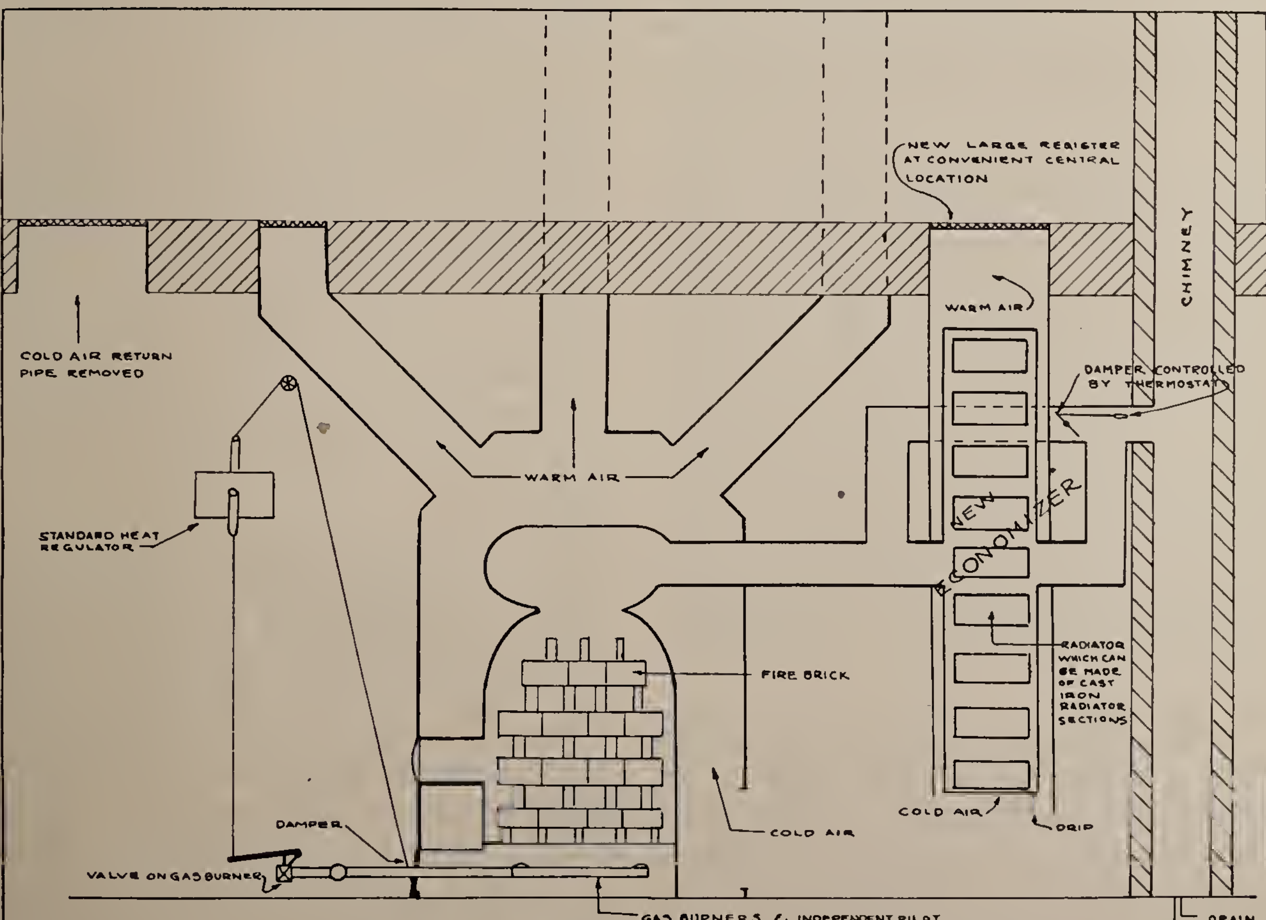
NEW LARGE REGISTER AT CONVENIENT CENTRAL LOCATION
CHIMNEY
WARM AIR
COLD AIR RETURN PIPE REMOVED
DAMPER CONTROLLED BY THERMOSTAT
WARM AIR
STANDARD HEAT REGULATOR
NEW ECONOMIZER
FIRE BRICK
RADIATOR WHICH CAN BE MADE OF CAST IRON RADIATOR SECTIONS
COLD AIR
DRIP
DAMPER
COLD AIR
VALVE ON GAS BURNER
GAS BURNERS & INDEPENDENT PILOT
DRAIN

FIG 2

S. S. Wyer (Columbus, Ohio): Since 1914 I have lived in an exclusively gas-heated house. Gas is used exclusively for heating, cooking, hot water heating and garbage burning.

With the temperature prevailing in Ohio on the coldest day, it is necessary to have gas coming into that house, in order to keep an eight-room house—two stories — twenty-nine by thirty-four, warm, at the rate, in manufactured terms, of 1,000 feet of gas per hour.

In other words, the peak demand on that house is equivalent to 1,000 feet of gas per hour. That peak does not occur every winter. In fact, it has not occurred for two winters. But when it does occur, unless the gas company can render service at that rate, the house is cold, at least in part, and the consumer will complain of poor service.

There is one feature that I think you are overlooking, and that is you are assuming that you will have a diversity. Bear in mind that there is this fundamental distinction: People cook at different hours—they get breakfast, they get luncheon, they get dinner, at different hours; they bathe at different hours—but all of the people in the entire town are cold at exactly the same time and for the entire time. When they are cold, they are cold all over, and the gas company that attempts house-heating service on a universal basis has to cope with that practical fact. You cannot evade it.

Coming back to my own case. On the basis of that demand, on an average of the capacity of that plant that is held there in readiness to serve for each hour in the year—I am using six and a half per cent of the total possibilities. You can easily see what that would do to the rate structure if everybody in town had a demand of that sort.

Another feature that you are overlooking is that in changing over and trying to convert a coal furnace into an efficient gas furnace, it is necessary to practically rebuild.

Eleven years ago I tested a large number of coal and gas furnaces. If you will take the average furnace, for the average eight-room house—a furnace built for coal—you will find that the fire travel in the ordinary coal furnace of that type is about seven feet. That is, it is seven feet from the top of the fuel to where the combustion products go into the chimney. As a result, you have a very high stack temperature, due to the fact that you do not have enough heat-absorbing surface in the furnace. Therefore, the average coal furnace cannot be converted into an efficient gas furnace.

In my own house the fire travel in the furnace is 32 feet. The combustion products travel 32 feet from the burner tip to the smoke exit. The efficiency of that furnace is 82% on actual test. The efficiency of the average coal furnace—burning coal—I am referring now to the average hot air furnace such as you have in the average house—is about 25%.

There is another feature that is lost sight of. A great many complaints are made regarding the inefficiency of hot-air heating systems. The efficiency of a hot-air heating system can be just as high as steam or hot water. One of the big problems is getting the air through the furnace. I am referring to the cold air. One of the easiest ways of getting around that difficulty is by merely installing a small fan in the cool air in-

take and driving more air through, and that simple expedient will immediately do two things. In the first place, it will cut down the fuel consumption very materially, and it will make possible the delivery of heated air service satisfactory to every room in the house.

In concluding, I would like to hold out this warning. If universal house heating, on the basis of meeting the peak load, were attempted in any community, it would wreck the gas company. You cannot carry universal heating service from any central public utility plant merely because the fixed charge situation is such that it is not sound economics to build a central heating plant—and that statement would apply not only to gas but it would apply equally well to steam or hot water—and hold that plant merely to render the peak load service that must be met if everyone is on a universal heating basis.

There is a very large field for increased heating service, but the way to handle the heating service is to require that the consumer shall have some auxiliary fuel to take care of the abnormally high peak that must be faced, if you are going to carry on house-heating service.

Member: Mr. Wyer has told us that the actual demand in a hot air system is approximately 1,000 cubic feet per hour. A heated house in Rochester, with approximately 20,000 cubic feet capacity, had an actual demand of 182 feet per hour on a day when the temperature was five below zero.

C. C. Krausse (Baltimore, Md.): We have 1200 customers, and in the last few months we came to the conclusion that we were heating, on the coldest day of zero weather, one foot of radiation, with around three-quarters of a cubic foot of gas.

Thomson King (Pittsburg, Pa.): The figures Mr. Krausse has given you are based not on one installation but on hundreds of installations. Any gas company that has been heating homes in a large way for the last two or three years will confirm those figures.

We have heard a lot of talk about the load factor of gas heating. There is just one other thing I want to call your attention to and that is the number of hours used for the maximum demand in a year, compared with other classes of business.

You get say 3,000 feet a month from a hundred feet demand on a gas range. That is 36,000 feet of gas used per year. You get 360 hours' use of the demand per year. Suppose the man has 400 cubic feet of radiation. I am taking Mr. Krausse's figures of three-quarters of a cubic foot of gas per hour per square foot. That man would have a demand of 300 feet, and that man would give you 1,000 hours' use of his maximum demand per year.

Any gas company that has had two or three years' experience will confirm these figures—whether it be for hot water, hot air, steam or vapor heating—those are definite figures. Your consumption per customer and per foot of maximum demand per year are larger for your heating business than any other class of business, and that is something that must be balanced against the fact that your heating business is only spread over certain months of the year.

And, remember, these figures are based on hundreds of installations.

Mr. Young (Louisville, Ky.): Our own town happens to be one of the border-line towns between the northern and the southern districts, and some figures from there might be interesting.

In an analysis of our customers recently, it was shown that at least as many as 70% of them used gas for heating purposes in their homes, either entirely or to heat such things as bedrooms and bathrooms in connection with coal furnaces used in the house when the weather became cold.

Mr. Wyer mentioned that he had a six and a half per cent load. We find our cooking customers use about 2,500 cubic feet a month, and with 100 feet as the demand for an ordinary gas range they have a three and one half per cent yearly load factor which is just about one half the load factor that Mr. Wyer says he has in his home for heating with gas.

Of course, it does not get as cold in Louisville as it does in central Ohio, and because of that fact, the maximum demand on the average gas furnace in Louisville is not as great as Mr. Wyer has in his territory.

The people in Louisville usually build their houses and equip them with furnaces which are not designed to meet maximum conditions. They never expect that they will have zero weather, and when they get zero weather they expect it to be just a little bit cold, and for that reason we may have much better load factors than it would be possible to develop in the northern sections.

But from an anaylsis we made recently, we are very much interested in this problem. We had a natural gas supply amounting to eighteen million cubic feet a day. Three years ago our load passed that in the winter time, and last year our peak load was twenty-six million cubic feet. This year the peak load will probably be in excess of thirty million cubic feet on a day when the temperature will be about 20. If it gets lower than that we will need more gas, and we must supplement our natural gas supply with manufactured gas. At the present time we are completing a plant which will have a capacity of twelve million cubic feet, which will probably only be used to its capacity two or three days during the coming year.

Before analyzing this thing carefully, we had been tremendously scared of this house-heating gas business, and worked along the lines that they are working on in Ohio, that the way to sell gas is to charge more for it when it is used for house heating than when it is used for other purposes. In other words, have a step rate going up instead of going down, and the price increasing with the consumption rather than decreasing with the consumption. But we have spent the last two months in making a very careful analysis of our costs, and find that we have been proceeding along absolutely erroneous lines, because an analysis of our costs, based upon the consumption of consumers and the demands that they had during the last winter, showed that the smallest consumers paid the least percentage of the actual cost of serving them, and that only when a man was heating a very large house was he paying the cost of actual service.

Of course, our situation was complicated down there by the fact that our rates, like many other gas rates in the country where we have a natural gas proposition, were not adequate. So it was a question of finding out what percentage of what they should have paid, the customers did pay, and that percentage was in exact proportion to their use.

Down in Louisville we find a man can heat a five-room house on a 120-foot demand, and that man will use 100,000 cubic feet in the year for heating purposes alone. On that basis he gets a

load factor which will run in excess of ten per cent, and that is three times the load factor that he shows on his cooking appliances, which is the only other load that we have down there, because we have never gone into the industrial gas business.

H. H. Clark (Chicago, Ill.): I think Mr. Wyer's statement as to the conditions in his home should be disregarded because they do not represent average conditions.

I heat my own home with gas, and my average is just half of his.

An analysis of a great many installations that I have had the privilege of investigating bear out the fact that in a house, such as mentioned by Mr. Wyer, five hundred feet would be about the maximum you could expect.

In regard to Mr. Vincent's paper, I do not see why he goes to so much trouble to accomplish his purpose. You can buy a complete hot-air furnace for about $75.00, and it would cost you that much to rig up the contraption shown in his paper.

We must not expect too much efficiency from a house-heating apparatus. You want to look at the safety feature. Your furnace is going to function some time in the day and night, and you will sometimes find that everybody is asleep. If your damper arrangement does not operate, or something else fails to go off when it should, you are apt to have trouble. I think we should sacrifice a little efficiency for safety and put in an apparatus that will be fool-proof.

A great many appliances have failed because they were too efficient, they were so efficient that they were not practical, and I think that is one of the warnings that the men should take regarding this house-heating business. We must have enough heat to have an active flue, and no two flues are alike on two subsequent days—one day you will have a draught in a certain condition and the next day it will be different. If you tried to have an automatic device to give you a certain draught, I do not believe you could build one that would work.

G. I. Vincent: This installation—the trial installation—has been in use now since about the first of September, and I think we will discard the automatic temperature control in the chimney. It seems to be unnecessary. The question of safety was very carefully considered in that design, and the damper stays open unless it is held closed.

Referring also to the last speaker's remarks regarding the purchase of the complete hot-air furnace, we do not know what this economizer would cost to put into production—there has only been the one made and it has been hand made, and at the present time I can not give you the cost. But there is no question about the efficiency being very high, and also that the cost will be low. Also it is a far better hot-air heating system than would be possible with a single unit. Rough checks on its efficiency in moderate weather show that it is considerably over 85% now.

I tried to say in my paper that I am not holding any brief for house heating at all. I think that we are going to get it, whether we want it or not, and we had better approach the thing in some logical way and see what we are going to do about it. Folks are going to do it—I do not think there is any question about that—and the point I tried to make was that you could cut down your demand materially by better house con-

struction, and also by increasing the efficiency of the utilization.

In this one installation the demand has been calculated—it has not been determined because we have not had any ten degrees below zero weather for which the equipment was designed. But it has been carefully calculated and the calculated maximum demand is something over 200 feet an hour. Whether we will reach that low figure or not, I can tell you better next year.

The point of using gas for auxiliary heating and coal or oil for the high demand, is very appealing, and it may be that that will be the ultimate solution of this problem. All we want to try to do is see what we can do with the gas and have something to work on. It is quite possible that we may be forced to make the other solution, to use another fuel for the high demand and the gas for the intermediate demand.

Member: Mr. Wyer has made a positive assertion with respect to the question, and inasmuch as the Baltimore people have had a substantial experience it might be well to ask them for their experience on this point.

The Chairman: Concerning the diversity factor, the assertion has been made that in central Ohio, when the people are cold, they are all cold. Does that check up with your Baltimore experience?

Member: I believe it would. But then, in reference to the diversity factor —everybody does not get up at the same time. That gives you a certain diversity there. Furthermore, in house heating the general factor is to economize and close some of the rooms. Therefore, you have a diversity factor of the actual amount of gas required to heat the house and the maximum amount required to heat the rooms in use. Then again, with a large number of heating installations on the line, there are always some people who are away.

I would say that we have a diversity factor of somewhere around 70%.

The next order of business was the report of the Sales Stimulation Committee.

REPORT OF SALES STIMULATION COMMITTEE

J. E. Davies, *Chairman,* Chicago, Ill.

This report treats, in a general way, with the subject of sales stimulation, and with the investigations, achievements, and recommendations of your Sales Stimulation Committee. Contrary to custom, there will be fewer words from the platform and more from the audience. Members who have put the Committee's suggestions to test will have an opportunity to tell us of their experiences. Undoubtedly, greater benefit will accrue from discussion of such experiences than from the discussion of this report.

Sales stimulation, in some form, is part of the program of every progressive manufacturer, wholesaler, jobber and retailer. However, activities that arouse real interest are the exception. *Real interest,* which is an incentive to buy, cannot be obtained by the application of mediocre sales methods. Extraordinary inducements must be offered to influence buyers at a time when the tendency is not to buy.

Regular changes of seasons, and the coming of certain established holidays, create a natural demand for gas appliances, household equipment, and merchandise sold by utility companies, but it is during the periods between the demand for "seasonable goods," that we must be on the alert to discover ways and means to make people *want* to buy what we have to sell.

Preparation for Dull Seasons

We must anticipate the downward trend in the curve on the sales chart and be prepared to meet it, face-to-face, with well-formulated plans for gaining nonvoluntary attention to our sales efforts. We must create a market when there is no market, and we must answer that weak-kneed proverb, "It can't be done," by doing it.

People are always curious to learn something, through a newspaper or billboard advertisement or through contact with a company representative, which involves for them personally a certain profit or something which will enable them easily to satisfy a certain want. A prospective customer is interested in anything that concerns himself, such as his welfare, his comforts, his ambitions, or his desire to save money in his business or his home. The primary source from which to secure ideas that grip the attention of the prospect is the prospect's own interests.

Real salesmanship is not order taking. Real salesmanship is an attempt to induce the prospective customer to buy an article for which he has not heretofore recognized a need. The clerk who jots down various items ordered by a customer is doing no actual sales work. The customer had already recognized his need for certain articles; he had already sold them to himself. Now he is merely telling the clerk what he wants. But if the clerk shows him his need for, and sells him something he had not planned to buy, the clerk then has done real selling.

The distinction in this simple illustration is worth noting, for it may well be applied in our efforts to stimulate appliance and merchandise sales, and ultimately to increase the sales of gas. If prospective customers have recognized their need of gas ranges, water heaters, room heaters, laundry equipment and other merchandise, well and good—they will come to our salesrooms and buy. But if they do not see the need for our goods between seasons, and they do not buy, it is because *the goods have not been sold to them.*

Salesmen Must be Competent

Only competent salesmen should be engaged in selling gas appliances and merchandise. The word *competent,* as used here, should not be construed to mean *perfect.* Salesmen are not to be expected to sell every prospect. No one ever batted 1,000. However, our representatives should know the science of selling and they should have sufficient initiative to find new ways that can be applied to the stimulation of sales every month in the year.

The securing of a prospect's confidence depends to a great extent on the enthusiasm and attitude of the salesman. If he has confidence in himself and in the merit of the goods he sells, and if he breathes that confidence into his sales talk the prospective buyer is not likely to doubt his sincerity.

Our task is to convince prospective customers that they will make no mistake in buying our goods. When we are trying to sell an article, we should prove to the prospective customer that our statements are true. Have facts and figures at hand to prove them. Have testimony from satisfied customers.

Present day merchandising of gas-fired equipment requires salesmen who have had experience in the gas industry and also a thorough and broad technical training.

The successful salesman of gas-fired house heating equipment must be able to calculate radiation, be conversant with the various systems of hot water, steam, vapor and hot air heating and be acquainted generally with heating and ventilating practices. Again, the salesman of hotel and restaurant appliances must be equally familiar with kilowatt hours and cubic feet of gas.

In short, these positions generally presuppose engineering training equivalent to a college degree. These men should, therefore, be engineers as well as salesmen. They sell, but at the same time they plan, lay out and recommend appliances, systems, policies and ideas.

Sales engineers are as necessary to a high grade merchandising organization as are certified accountants in the accounting division, and recognized legal authority in the corresponding departments of a gas company.

Demonstrate Salient Features

It has been said that too much talk has killed many sales. That may be true, but it is also true that many a sale has been lost because the salesman has not demonstrated fully to the customer the salient features of the articles that are especially adapted for his use. It is not sufficient to say that a certain type of room heater is "a good heater" or "it is just the heater for your requirements," or "I can assure you that you will be satisfied with this heater," or "you will not be annoyed with soot or ashes." These are all good selling points, but the important point is that the heater radiates heat, *throws it out into the room;* that's what the customer wants to know. He is interested in what is adapted for his use. The same fundamental principle applies to the sale of all appliances. There is an outstanding feature in every article we sell, which has a special appeal to the buyer. If we overlook the feature that interests him, we may lose a sale.

Training the Sales Force

Training and education of salesmen is valuable to every sales organization Instruction meetings should be held daily semi-weekly, or weekly. These meetings should be in charge of supervisors or managers of sections. Salesmen should be encouraged to enter into animated discussions of subjects related to the selling of appliances and merchandise and they should be required to write short papers on subjects assigned to them by the sales manager. Practical educational developments stimulate sales.

It has been the desire of the committee, in sending out its sales stimulation bulletins, to suggest ideas that would be adaptable to the sales organizations of large and small companies alike. Many requests from manufacturers, as well as from gas companies throughout the country, for additional copies of the bulletins, have been very gratifying. This interest is indicative of enthusiasm. It means that many of our members have determined not only to bring sales up to normal, during the so-called valley months, but to show an increase over the corresponding period for the preceding year.

Results of Sales Stimulation Plans

The Peoples Gas Stores in Chicago adopted the plans outlined by the Sales Stimulation Committee in the January—February—March bulletins. Their sales increase for the first twenty days in January, 1923, as compared with the corresponding period for 1922 was 25.7%. Plans recommended by the Committee in subsequent bulletins were also adopted On June 30, the increase for the first six months of 1923 was 23.4% over the corresponding period for 1922.

The Public Service Gas Company of New Jersey increased its water heater sales 100% last year largely through a "wagon campaign" which is described in the April—May—June bulletin.

Thousands of obsolete appliances have been replaced by efficient up-to-date appliances, in accordance with recommendations in the July—August bulletin.

The fact that appliances are old and worn out leads to many complaints of inadequate service and is the cause for frequent attention and adjustment. Customers do not usually blame the appliance, or its inadequacy—they are more apt to attribute the trouble to the quality of gas or to blame it upon the company's poor service. Hence, the service suffers in popular esteem, the obsolete appliances are not likely to be used, and the sales of gas are therefore corrrespondingly reduced.

At the time of writing this report the committee was not in a position to know the outcome of recommendations contained in its bulletin for September, October, November and December. This bulletin offered a number of suggestions for stimulating sales during cold weather and during the holiday periods.

Sales Stimulation bulletins were sent to all member companies throughout the year. Copies of the bulletins are appended to this report.

The Committee has not made investigations with regard to stimulation of Industrial Gas Sales. This very important item will be the subject of an independent paper.

Educating the Housewife

Now after all that we have said and done there still remains something of vital importance. In order to stimulate sales we expend a great deal of time and energy and money. We accept small first payments, grant liberal credit terms, give away substantial premiums, and make allowances for old appliances turned in when new ones are purchased. Something else must be done after the customer has begun to use the appliance. There must be a ceaseless campaign of education to instruct the housewife in the many ways that gas may be used for domestic purposes. Your Committee is strongly in favor of a Home Service Bureau or Department of Home Economics for this purpose.

Responsibilities of the Sales Department

Selling is the most important function of business; all other functions are auxiliary. To be sure, all other functions are essential to the efficient operation of business, but they are essential because they are highly important aids to the main function. However, in our eagerness to stimulate sales of appliances and merchandise, let us not, for one moment, overlook the fact that primarily, the Sales Department functions to increase the consumption of gas. From the standpoint of gas company management, gas sales are paramount to the sales of appliances and merchandise.

The Sales Department must do its part in the promotion of gas sales by rendering a quality of service that will insure friendly relations with customers. It is the duty of our salesmen to recommend only such appliances that are best adapted for a customer's use. Any follow-up system for the purpose of ascertaining that newly installed appliances are operating efficiently, will be appreciated by customers. Sometimes this gratuitous service results in the sale of additional appliances.

We should, of course, co-operate at all times with plumbers and heating contractors in our respective communities by furnishing any necessary information or assistance with regard to gas installations.

The real result desired in a co-operative plan is to encourage the plumbing and heating trade to recommend, sell and install in a suitable manner, as much gas-fired equipment of acceptable make as possible. Whether they buy it from the gas company or whether they sell the same make as the gas company is not important, as long as the appliances they do sell are good appliances. The result we really are seeking is the sale of more gas; therefore, honest and friendly competition is desired. The making of a sale to this trade as far as a merchandising transaction and profit is concerned is of little importance.

Enthusiasm the Keynote

Nothing great was ever achieved without enthusiasm. Becoming excited is not enthusiasm. Some one has said that "Enthusiasm is proof that a man believes in a thing." Salesmen and sales managers must be fountains of enthusiasm if they expect prospects to become enthusiastic over their sales projects. We must study our goods from every angle, read about them, talk about them, experiment with them, know them, know them so well that no amount of cross questioning, criticism or doubt can possibly confuse us.

We of the Sales Departments, who stimulate sales, are the go-getters of the gas industry. We believe that no one has ever invented a good substitute for work; therefore, we must create a market for our goods, when there is no market; turn dull seasons into good seasons; twist the curves upward on the sales chart when the trend is downward, and pull the valley months up to the peaks. We must find new uses for gas in old places and old uses for gas in new places. There is a market for gas appliances and merchandise the year around. We can sell that market, but it won't come to us out of season.

The Committee recommends:

1. Training for new and old salesmen.
2. Sending letters of appreciation to customers who open new gas accounts.
3. Following appreciation letters in ten days with Appliance and Merchandise sales letters.
4. Merchandising ads in daily newspapers, advertising on gas bills, publishing pamphlets, direct by mail, billboard.
5. Appropriate and attractive window and floor display.
6. Invitation to all employees of the company to join in sales campaigns by sending in prospects.
7. Prizes for prospects that result in sales.
8. Allowances on old appliances turned in when new appliances are purchased during July and August.
9. Prompt attention to all complaints.
10. That the Sales Stimulation Committee be continued for another year.

Appended to this report is reproduced the text matter which appeared in the Gas Sales Promotion Bulletins issued by the Sales Stimulation Committee during the year.

GAS SALES PROMOTION

Recommendations of
The Sales Stimulation Committee Commercial Section

JANUARY FEBRUARY MARCH

Increase Your Off-Peak Gas Merchandise Sales

A LET DOWN in the public demand always follows immediately after the Christmas holidays. The department stores are quick to sense such a condition and stimulate their sales in this off-peak period by special inducements as to price and terms in "January White Goods Sales," the "February Furniture Sales," etc.

In this Bulletin the Sales Stimulation Committee recommends to member gas companies two plans to greatly increase appliance sales during this off-peak period. In addition, the shop force will be kept occupied and the sales organizations will remain interested and active.

The plans suggested herein have been used successfully before. The unequalled facilities of the gas companies for establishing the credit of their customers and for making collections are a further argument in favor of their adoption.

Good merchandise paper is far preferable to stock on hand.

RECOMMENDATIONS

Three Special Offers During January—February—March

1. Accept $2.00 as the initial cash payment with order.
2. Extend time payments over an 18 months' period.
3. Offer some premium to be given free with the purchase of your higher priced permanently connected gas merchandise,—that is with sales of cabinet gas range, storage water heater, fireplace heater, etc.

The following suggest themselves as suitable premium offers:

- Enameled kitchen table
- Set of aluminum cooking ware
- Set of dishes
- Set of silverware
- Set of kitchen cutlery
- Ironing board
- Kitchen stool

The A. G. A. Headquarters will on request furnish the names of manufacturers who would be in a position to supply such merchandise for premium offers at an attractive price.

The Peoples Gas Stores last January distributed 5000 enameled kitchen tables with sales of their gas merchandise and this January will offer a 26-piece set of silver plate, illustrated in the window displays in this Bulletin and consisting of:

6 Knives	6 Tea Spoons
6 Forks	1 Butter Knife
6 Dessert Spoons	1 Sugar Shell

The above premium will be given to each purchaser of an appliance such as cabinet ranges, automatic water heaters, laundry equipment, radiant fires of the better quality, kitchen cabinets, etc.

Special Price for Double Sale

Offer a special price to both purchasers where a double sale is made. As an example, assume your price on a certain appliance is $50.00; offer two at say $90.00. This would be in effect a club plan with an inducement for a customer to interest some friend or neighbor to join in the purchase of two appliances where ordinarily but one sale might be made.

The Split-Tag Idea

The split-tag idea, as illustrated, is intended to offer the salesman an entree to the prospect's premises. The stub is turned in by him to the office as an evidence of his call and also acts as a check in determining his credit in case the prospect calls at the office later and makes a purchase. The tag left with each prospect called on acts as a constant reminder of the special terms and premium in case a purchase is made during the life of the company's special offer.

Inducement to Salesmen for Cash Sales

An extra inducement for salesmen to make cash sales rather than deferred payment sales is to offer them an additional one per cent commission.

Inducement to Other Employees to Turn in Prospects

Cash or special premium offers could with advantage be offered to employees, other than the salesmen, for the largest number of sales made to prospects whose names are turned in. A certain number of credit points could be established for each type of appliance, the winners being the employees receiving the highest number of points during each week or each month. As a stimulus to such competition the names of employees who have turned in prospects and the number of points earned could be posted in some conspicuous place in the company offices and sales room.

General Suggestions

The discount period for paying gas bills is an opportunity to increase floor sales. The cashier should be instructed to call the attention of each consumer to the company's special terms and premium offer, at the same time handing out a printed slip giving the details of the offer.

A special prospect list could be made up of all customers whose monthly bills average 2,000 cubic feet or less. Have the sales force work on these prospects intensively, for they offer possibilities for making merchandise sales and increasing gas consumption.

Keep in touch with all building permits and contracts, also electric wiring contracts in your community and immediately follow up the architect, electrical contractor, builder and owner in an endeavor to have gas piping and necessary outlets installed for side brackets, base board and fireplace outlets.

Nothing is so important as having your entire organization interested and working as a unit. Every employee should be informed of your sales and publicity plans and special inducements to employees. Have a general meeting and go over the details of your plans, supplying them with copies of your advertisements, special notices and sales talks.

Advertising Copy

Members are referred to the A. G. A. Merchandise Advertising Copy Service which is now being sent monthly to over 200 subscribing gas companies. This service consists of one "good will advertisement," four "chat" ads, and eight distinctive and original pieces of gas merchandise copy. All the merchandise copy is illustrated. This sales bulletin contains a number of suggested newspaper advertisements which could be used as reproduced or changed to meet the varying needs.

Window Displays

These are a most effective help in selling and particular attention should be given to making your windows attractive and tell your story. A number of suggestions for window displays are reproduced in this bulletin.

Assistance from Manufacturers' Representatives

The manufacturers of gas appliances have been requested to co-operate in this business getting movement by having their sales representatives assist the gas companies. It is believed that such co-operation will be mutually helpful to the gas companies and the manufacturers.

The Sales Stimulation Committee will appreciate some expression from the member gas companies which will give assurance to the committee that the plans offered, at least in part, will be adopted.

Recommendations of The Sales Stimulation Committee—Commercial Section

Automatic Water Heater Campaign

APPROXIMATELY 75% of the cooking appliances sold annually are replacements, but it should be remembered that such replacements eliminate the worn out and obsolete types which create the dissatisfied customer, whereas the new appliance, even though it be a displacement, means a satisfied consumer and a maximum user of gas.

The conditions are somewhat different in the field of water heating for with 7,000,000 domestic gas cooking appliances in use and only 1,500,000 gas water heaters on the lines, there opens up a wonderfully productive future for gas sales in what is practically an undeveloped field.

In attacking this tremendous unsold market it must be constantly kept in mind that gas will never be universally used for water heating unless the gas companies adopt and strictly adhere to a policy of,—first, selling only appliances of the highest standard of quality and efficiency; second, installing only the right appliance in the right place; third, maintaining systematic and high class inspection and maintenance of appliances installed; fourth, supplying instruction to the customer in the proper and economical use of the appliance.

Last year the Association advocated a continuous and major sales effort of automatic water heaters by the member companies. That effort must be continued and repeated year after year if we are to reach our fullest expectations in this direction.

The following suggestions are offered by the Sales Stimulation Committee of the Commercial Section in the hope that they may contribute in some measure in starting a concerted effort throughout the industry to sell the public the idea that for heating water you can do it better with gas.

Recommendations

Sell the Water Heater Sales Plan to the Entire Organization

It is essential that your entire organization, especially the sales and shop force, be fully sold on the possibilities of gas water heating. Meetings of the sales representatives, shop and maintenance men, and others coming in con-

tact with the public, should be held at intervals at which time your sales plan should be fully explained and discussed

The paper on "Automatic Water Heating," presented by Mr. E. C. Bartlett at the 1922 Convention, is a masterful and inspirational treatment of this subject, and it is suggested each member of your organization be supplied with a copy. This paper is published in the 1922 Proceedings of the Commercial Section, pages 52 to 78. Also the pamphlet, "Heating Water by Gas," by Mr. N. T. Sellman, which exhaustively treats of the correct methods of estimating the requirements and of selecting the proper equipment and shows the proper method of installation, will be extremely valuable. This paper appeared in the A. G. A. Monthly for May, 1922, and can be had in pamphlet form at A. G. A. Headquarters.

List of Present Users and Operating Cost Data on Such Installations

Testimonial letters from satisfied users can be used to advantage by the salesmen and in your advertising copy. Prepare a list of your most recent water heater installations and write asking for opinions as to the satisfaction of the equipment and the service it is giving. If any complaints arise from such a request these should be satisfactorily adjusted before starting your campaign. A dissatisfied customer will influence others in the neighborhood.

Gas bill records for a period of a year or more should be prepared, giving comparative gas consumption before and after the installation of the automatic water heater; also data regarding the number of people in the household, so that the cost per person per month for hot water service may be arrived at. If possible, actual figures on amount of water used should also be secured. Such data will be very useful to the salesmen, particularly in making quotations to prospects in the same neighborhood.

Dividing the Territory into Districts and Setting Sales Quota

Establish a total quota of the number of water heaters of all types you expect the organization to sell and apportion this quota equitably among the sales representatives. Nothing is so discouraging to a sales organization as preferential assignment of good territory. Give an impetus to such a sales contest by periodically posting the names of the sales representatives, giving their quota and a record of their sales. An extra inducement in the form of some premium offer or bonus commission for the best sales record will be an added inducement to increased effort.

Length of Campaign

In view of the immensity of this unsold market, it is suggested that the campaign be carried on over a period of at least three months—preferably during April, May and June, and in setting the sales quota for the organization the length of the campaign should be a determining factor.

Publicity

There are many publicity channels for reaching your water heater prospects. They should all be employed to present convincing arguments on behalf of the many uses of hot water and the advantages of an automatic heater.

1. Make your newspaper advertising the feature of your publicity. Prepare advertisements which are designed to tell the advantages of gas service for hot water requirements rather than to play up the merits of a particular water heater. Your ads should be instructive, give comparative costs of heating water with gas vs. coal,—the amount of hot water required daily by the average family and cost of heating the necessary quantity.

2. Circularize the prospects with a letter in which should be set forth any special features of your water heater sale, and a visualization of the many needs for hot water and the advantages of the automatic heater. Enclose with this communication such literature as you may prepare specially for the campaign or which you may have secured from the manufacturers.

3. The use of delivery wagons for display of signs, giving the dates of your campaign and special offerings, will be found an excellent tie up with your other publicity.

4. The gas bill reaches every one of your customers. It also offers an excellent method of conveying a hot water message,—either imprinted on the back of the bill or as a sticker.

Displays

Use window displays made attractive by having heaters in operation,—mechanical devices or settings of water scenes, with suitable backgrounds telling the story of hot water. Window demonstrations always attract a crowd and create interest—the installation of an automatic water heater in the window with the demonstrator performing the operation of washing dishes, clothes, etc., or a bathroom scene, will bring results.

Salesroom displays should be arranged so that heaters of different types are connected and available for demonstration to propective users, builders, architects and dealers. An actual demonstration in the salesroom will usually be a closing argument for a sale.

The Public Service Gas Company of New Jersey increased their water heater sales 100% last year largely through a "wagon campaign." A supply of heaters on auto truck followed the sales crew into the various districts, thus making immediate deliveries available and demonstration possible. (Full details of the wagon drive plan will be supplied on request.)

Prices and Terms

Cutting of price should not be tolerated; there are sufficient inducements for the prospect to buy by offering a plan of small initial payment, extended

terms, and an attractive premium offer, with allowance for old and obsolete heaters taken in exchange, so that it should not be necessray to cut prices. Price reductions are demoralizing as they open up "lines of least resistance" for the salesmen and they engender a spirit of antagonism on the part of the plumbers and dealers. In the case of new buildings offer to put an automatic storage heater in on a 30 or 60 days' approval basis. This should convince the skeptical builder of the value of adding this equipment to the home. The advertising value of such a trial installation should not be overlooked. For every person who buys there will probably be fifty inspecting such new houses, and seeing such a water heater equipment installed they will naturally be interested and become more familiar with the automatic type of heater.

Dealer Cooperation

Dealer cooperation is essential to the successful operation of a water heater campaign. Plumbers can be interested in your campaign and their support should be secured. Make it possible for the plumber and dealer to sell automatic heaters in fair competition with you at prices at which they can make a profit and under some arrangement whereby they may secure deliveries from your stock. Then, they will be your strongest allies. We have gone on record officially before the Master Plumbers' Association of America as desirous of bringing about friendly relations and a workable cooperation with them; therefore, in the water heater campaign let us give some tangible evidence of our sincerity of purpose in this direction and invite them to join with your company in this campaign. Remember that, in the final analysis, it is the increased sales of gas which mean the most to your company.

Service and Follow Up

Nothing will be so detrimental to your campaign as delayed deliveries, poor installation and unfulfilled promises of your representatives.

The actual sale and installation of a heater is by no means the end of the company's obligation to the customer. A careful follow up of all installations should be made to ensure the proper installation and operation of the heater and the customer should be carefully instructed in its care and operation. A high class instruction and maintenance service will be a big factor in determining the future gas sales from these installations.

Assistance from the Water Heater Manufacturers

The manufacturers of water heaters will be found willing and ready to render every assistance possible. They have available and will supply free booklets, suggestions for advertisements and window displays. The traveling representatives of the manufacturers will be of great help in planning your campaign and in giving instruction and inspiration to your sales force.

The Sales Crew

Selling automatic water heater service should be a specialized effort, therefore, it is suggested that the men who will be delegated to this task be carefully selected and instructed. The manufacturers' representatives will be of great assistance in this matter. Where feasible and the necessary arrangements can be made with a manufacturer, it is a good plan to send one or more of your salesmen or fitters to the factory for first hand information in the construction and selling points of the water heater. Meetings of the sales and shop forces should be held frequently during the campaign, at which time details and progress of the campaign may be fully discussed.

Much lost motion and expense of canvassing will be avoided by making a preliminary survey of the territory. This may be done by the regular salesmen, meter readers, or a special crew working independently or in conjunction with the regular force. The following information will be disclosed by such a survey and will be helpful to the salesmen in their calls.

1. Existing installations working satisfactorily or not, in which latter case immediate adjustment should be made.
2. Old heaters which should be replaced by modern types.
3. Where no heaters are in use.
4. Number in family, approximate hot water requirements for the family and present method of heating water.

Compensation

An added incentive to the sales force is to offer some special bonus or premium in addition to regular salary or commission to those who exceed their quota. Another plan is to give extra commission based on either actual or estimated increased gas consumption after a water heater sale is made.

Some special inducements and arrangements for the employees to enjoy the advantages of automatic water heater service in their homes should be made. It is hardly possible for those in the field to be wholeheartedly enthusiastic unless the officials of the company and the employees themselves are thoroughly sold on the merits of automatic gas water heating.

Remember there are several million good prospects for gas water heater equipment. LET'S SELL THE IDEA TO THEM.

GAS SALES PROMOTION

Recommendations of The Sales Stimulation Committee—Commercial Section

General Merchandising

THE SPRING MONTHS of 1923 offer a splendid opportunity for gas companies to merchandise their general line of appliances. With practically every industry in full production, the percentage of unemployment is relatively small and people have money to spend. With such favorable conditions confronting us, there should be every incentive for unprecedented sales activity among gas companies.

The ultimate goal of our effort is the promotion of gas sales and it is only natural that the more diversified becomes the use of gas, the greater will be the volume of gas sales. As a means to that end, the sale of appliances becomes an increasingly important function of the sales department.

May and June should be the best merchandising months of the year. We hope that the suggestions offered in this Bulletin may assist in making sales for the Spring of 1923 surpass any figures in the history of gas companies.

RECOMMENDATIONS

Combining Sales of General Merchandise with Water Heaters

We have already chosen the months of April, May and June for an intensive gas water heater sales campaign, plans for which were outlined in a bulletin issued very recently. However, the Spring season of the year—particularly the Spring season of 1923—is so promising from a business standpoint that we should not only concentrate upon the sale of gas water heaters but devote our best efforts to selling other appliances as well. Indeed, Spring 1923, should see gas companies running up the biggest merchandise sales in their history. The opportunities for doing this were never better than they are now.

The Best Merchandising Months of the Year

May and June are big months for go-getters in our business. It is then that people move from one house to another or go into their newly built homes. It is the season of housecleaning—the season when an inventory of old appliances is taken by most housewives and when the desire for new things is at its height. The old range, water heater, portable or fireplace

heater, gas iron or other appliance that looked so bad in the winter, now looks ten times worse. Thus the element of sales resistance is practically non-existent and the approach of the salesman is made much easier.

If the Spring sales' program is to be a success, however, there must be at least one dominant appeal directed at the public. Let that appeal be—

"Your Gas Company is the Logical Place to Purchase Gas Burning Appliances"

Stress the fact in your newspaper advertising, sales letters and other literature that your company is headquarters for gas-burning appliances—the logical place for your customers to come in search for quality appliances that are built in compliance with specifications. Tell your customers that you handle only the best equipment obtainable and that your assortment of appliances—and your prices—are right and your terms arranged to fit any pocketbook. And when you make these statements remember that they are tantamount to an invitation to visit your offices and to see at first hand whether you are telling the truth or not.

Concentrate Your Selling Efforts on Certain Appliances

Once you play up the selling point that your Company is Gas Appliance Headquarters, pick out a line of appliances—gas ranges, fireplace heaters, laundry equipment, etc.—and concentrate all your effort on them. June is the month of brides and a gas range appeal should be directed at them and at the general public. You can precede it with a drive on laundry equipment, heaters, etc., to fit a prearranged selling program, stressing the big point at all times that your company is headquarters for every thing that is "quality and service" in the gas appliance field.

Make Your Showrooms and Windows Reflect the Spring Season

The Spring season lends itself admirably to the display of gas-burning appliances under the most favorable conditions. Several reproductions of window displays with spring decorations and backgrounds are shown here, but the displays should be diversified to show not only ranges and water hearters but heating appliances, lighting equipment, gas irons, laundry machinery and other lines of merchandise.

To tie-in with the general effect produced by the windows, the showrooms should be made particularly attractive and wherever practicable appliances should be displayed in actual operation so that demonstrations can be given. This idea of the practical demonstration, so effective as an attention-getter, should be extended to show windows if they are large enough.

Another idea to bear in mind is that the customer comes into your office twelve times a year to pay his bills. Each time he or she calls, the windows

should contain different displays, so that over the period of a year your entire line of merchandise will have been displayed.

Plan to Get More Business from New Homes

The country is in the midst of a gigantic building construction boom, and no gas company should relax in its efforts to get a maximum amount of business from new homes. It may be advisable to make an offer to private and speculative builders such as that made by one company, as follows:

We will place in new houses, upon the completion of same, an automatic storage water heater, oven heat regulator range or a fireplace heater, or all of the above three articles, on a 30 to 60-day approval basis.

"This offer, of course, is given only to those persons or firms whose credit warrants the extension of this privilege."

Timely and Attractive Newspaper Advertising

The advertising material to be obtained from appliance manufacturers and other sources is of such excellent character today that a complete campaign can be carried on without much detail work. It is important, however, that your advertisements gain a maximum of reader attention and to this end it is suggessted that preferred positions b used. One of these positions should be adjacent to society notices or local news items. By running a sustained advertising campaign throughout the summer and by contracting for a larger amount of space than has been your custom, your newspaper publishers, if approached in the right manner, will grant you a concession in the way of preferred positions at regular rates. Many gas men overlook this advantage and in the enthusiasm of pushing a campaign to its finality, permit the newspaper to use its discretion in placing advertisements. This practice finally degenerates into a habit, seriously militating against the pulling power of the most effective advertising.

Prices and Terms

1. *Accept one-tenth to one-fifth down as initial payment with order.*
2. *Extend time payments over a nine to twelve months period.*
3. *Discourage the use of a premium as an inducement to buy during this period.*

Getting Co-operation from Your Employees

With attractive showrooms and windows, effective newspaper advertising, several strong sales letters, and the right prices and terms, you have only to get full support from your employees to complete the sales chain. In addition to the regular sales force, who may receive extra commissions or com-

pensation, the interest of the entire organization should be enlisted. This can be done in several ways, one of which is to offer cash or other prizes to the employees who turn in names of prospects which result in sales. In another part of this bulletin is reproduced two pages from a four-page illustrated printed letter signed by Charles A. Munroe, Vice-President of the Peoples Gas Light and Coke Company of Chicago, and addressed to the employees of that company. Mr. Munroe's letter deals entirely with the sale of gas water heaters but it could deal just as well with other appliances and should be suggestive for many other uses.

Boost "Better Homes Week," June 4th to 10th

President Harding and the Governors of States will proclaim the week of June 4th to 10th, 1923, to be Better Homes Week. This movement is national in scope, strictly non-commercial in character, and is under the supervision of Mrs. William Brown Maloney, editor of *The Delineator,* 223 Spring Street, New York City, to whom inquiries should be addressed. It is the finest movement of the kind ever attempted and holds forth some splendid advertising and educational possibilities to gas companies.

In October last year, during Better Homes Week, 961 towns and cities put on demonstrations and there were over 500 model homes equipped and exhibited to the public. New Haven got the first prize—and the gas company there co-operated so well with the local committee (composed in practically every case of the best known women in town) that many kinds of gas appliances were installed and viewed by thousands—all without cost to the company.

It is anticipated that about 1,000 model homes will be equipped and exhibited in June 4th to 10th this year. If there is a Better Homes in America Committee in your town, give them every co-operation possible and get the most complete model home gas installation you can, including some or all of the following:

Gas range
Fireplace or portable heaters
Gas steam radiators or central heating plant
Automatic water heater
Gas laundry stove
Gas ironing machine
Semi-indirect gas lights and socket gas brackets.

In the event that there is no committee in your town, or no model home proposed, you can do either one of the following things:

1. Choose the name of a local woman of importance, send her name to Mrs. Maloney and ask that she be appointed chairman of a Better Homes

Committee. Once the movement starts, give it your fullest co-operation, especially the model home.

2. Play up Better Homes Week in your advertising, window displays, etc. Take advantage of the national movement by applying it locally. Exhibit a model kitchen, model laundry, etc., in your showrooms and invite the public in.

Recommendations of
The Sales Stimulation Committee—Commercial Section

Eliminate the Old and Obsolete Appliances

ATTENTION IS CALLED to the number of old and obsolete domestic appliances that are in service throughout the country. The fact that they are old and worn out leads to many complaints of inadequate service and is the cause for frequent attention and adjustment.

Consumers do not usually blame the appliance or its inadequacy—they are more apt to attribute the trouble to the quality of the gas or to blame it upon the company's poor service. Hence, the service suffers in popular esteem, the obsolete appliances are apt not to be used and the sales of gas are therefore correspondingly reduced.

The Sales Stimulation Committee urges the co-operation of every member company in a concerted effort to replace with modern, up-to-date equipment, all the appliances on their lines which through obsolesence have outlived their usefulness.

Recommendations

Preliminary Survey and Its Usefulness

Concentrated sales effort upon those customers who are using old and inefficient appliances can be most satisfactorily directed by first knowing where such obsolescent equipment is installed; such a preliminary survey could be made either by your meter readers, the regular sales force or a special crew selected for the purpose. A careful record should be kept of the equipment in all premises as this information will be useful from time to time when other special campaigns on water heaters, ranges, heaters or lighting appliances are undertaken.

In a survey of this character it may be considered advisable to make a careful analysis of the condition of the gas equipment in the various classes of premises, such as dwellings, apartment houses, hotels and restaurants, etc., in which case it will probably be necessary to put special men on the survey of the hotels, restaurants and institutions. With such a survey before him the sales manager will be in position to direct specialized sales effort to reach these various classes of prospects rather than to depend upon one general campaign to reach them all. The equipment in hotels and other

large institutions if not in good condition will seriously influence gas sales. This class of customer must be looked after by experienced representatives as the usual arguments for interesting the domestic customer will not be sufficient to interest the hotel and restaurant owner whose equipment is subject to hard usage and must be kept in A-1 order and up-to-date.

In case the preliminary survey is not feasible it is suggested that a special notice (post card or letter) be mailed to all your consumers, advising them of your offer and stating that your representative will call on such or such a day or during a certain week. The customer should be telephoned as a follow-up effort or in case a sale was made, to thank the customer and promise prompt attention to the order.

Duration of Campaign—July and August

It is recommended that this particular drive be conducted during the months of July and August. Usually there is a let-up of sales activity during the summer months and a special effort of this character will give the salesman an opportunity of doing business during a dull period, thereby keeping up his interest, increasing his earnings and at the same time give him an opportunity to comb his territory.

Allowance for Old Appliances

It is human nature to fix in mind some tangible value to any article owned, regardless of whether it has a market value or not; therefore, in this case it becomes necessary to offer some inducement for replacing the old appliances with new ones.

The following schedule of allowances is suggested:—

$10 for old ranges with double ovens
$5 for old ranges with single oven
$10 for any coal burning water heater
$10 for any coal burning range
$10 to $20 for old automatic water heaters
$5 for an old gas log when replaced by a radiant type of heater.

Care should be taken to see that old appliances turned in have actually been on the lines. Old appliances should not be left on the premises but removed at the time the new one is delivered and connected. Keep the old appliances from getting back on your lines, otherwise you defeat the purpose for which they are removed. Break them up and dispose of them as scrap metal, possibly donating the proceeds to some worthy charity. This latter plan will make good local publicity for the campaign.

Do not cut your regular prices on new appliances—allowance for old equipment, small down payment with extended time payments give a sufficient inducement without the necessity of cut prices, which are usually

apt to create antagonism of the local dealers and in addition establishes a policy which the public will expect to see followed in subsequent sales.

If a preliminary survey has been made such records will disclose the number of obsolete ranges or water heaters on the lines. Effectiveness to the campaign might be given by announcing that the company will give an allowance for a given number of old appliances during the period of the campaign,—this figure may be made sufficiently high to cover all the allowances which will be necessary. If the survey shows 1,000 old ranges on the lines and you can reasonably expect to replace 200 with new ones during the campaign, then you can safely say, the company will make a certain allowance for the first 200 old ranges turned in, and in similar manner with other appliances. The effect would be that many prospects will take prompt steps to get in on the offer for fear they might be left.

An offer to *give free* a new cabinet gas range to the person turning in the oldest gas range during this period will be a novel feature and give opportunity for some publicity. A modification of this offer might be to *give free* a radiant heater or water heater to the customer buying a new range and turning in the oldest range.

Advertising and Displays

Supplement the efforts of your sales organizations with suitable local advertising and attractive window and show room displays. Make your newspaper ads tell the story—have them illustrated to attract attention and don't crowd the space with too much copy (subscribers to the A.G.A. Merchandise Advertising Copy Service will find in the July copy timely suggestions of advertisements to fit in with this campaign).

Too much attention cannot be given to your window displays—if the idea is adopted of giving a new range free for the oldest one turned in, capital could be made of this plan by exhibition each week the oldest appliance turned in as well as the appliance to be given away—this should create some friendly rivalry. At the end of the first week exhibit the oldest stove turned in. Placard this stove, giving its date and history, and announce that it is the oldest turned in to that time but that it will be supplanted during the following weeks of the campaign if a still more ancient one comes along. Another display could be several of the oldest stoves and other junked appliances on one side of the window and opposite the modern up-to-date equipment.

A display consisting of two ranges, one an obsolete type, the other the up-to-date cabinet stove, each connected with a separate meter, will be a striking evidence of the wasteful gas consumption of the old over the new.

Placard all your delivery and service wagons with a suitable announcement of your plan—place signs in conspicuous places in your show rooms,

over the cashier's window, at the application desk, on the counters or whereever they will be noticed.

Interest Your Sales Organization and Other Employees

The success of any service or selling campaign is determined largely by the co-operation and interest of your own organization. As suggested in our previous sales bulletins (copies of which are obtainable on request) the entire organization should be sold on the plan. Get them together either by departments or where feasible in one group and go over your plan in detail. Ask for suggestions—you will be surprised how many valuable ideas will be forthcoming from such a group if you secure their interest.

Co-operation of the Plumbers

The co-operation of the plumbers in your territory might well be considered in connection with this plan and to this end it would be advantageous to have your plan fully explained to them either by letter, a special representative or at a meeting called for the purpose. Under such a plan it will of course be necessary to make some arrangement with the plumbers which would make it worth their while to co-operate.

The Sales Bulletins referred to contain many sales and publicity ideas which are applicable to a campaign for eliminating all the obsolete equipment from your lines.

In the January 13 issue of the *Gas Age-Record* there is a particularly timely article on "Pulling Door Bells," copies of which if placed in the hands of your salesmen would undoubtedly have a stimulating influence and disabuse their minds of the fallacy that house to house canvassing is not remunerative or that it can be made a dignified job—*it can!*

Conclusion

Your Sales Stimulation Committee earnestly recommends that every member company engage in this effort for it will ultimately have an influence in bringing your non-profitable consumers over into the profitable class.

GAS SALES PROMOTION

Recommendations of
The Sales Stimulation Committee—Commercial Section

SEPTEMBER — DECEMBER

Fall and Winter Gas Merchandising

THE FALL AND WINTER seasons offer splendid opportunities for the sale of gas appliances and household equipment.

During her summer vacation the housewife has had the time to discuss and plan with the other members of the family necessary improvements and new equipment for the home, and the early Fall finds her in a receptive mood for suggestions as to new kitchen and laundry equipment, new lighting fixtures and heating appliances.

The retail merchant is alert to take advantage of the shopping inclination during this season of the year and he accordingly makes special attractive merchandise offerings, backed up with attractive displays, appealing publicity and intensive sales effort.

The gas company can and should be the leading merchant in the community. It has a public service to perform, the fulfillment of which will bring its reward of increasing sales and public good-will.

RECOMMENDATIONS

A Good Merchandising Season

The Fall and Winter months are particularly good seasons for merchandising a diversified line of gas appliances and this year the Appliance Sales per Meter should be unusually high. The shortage of coal opens up a wide market for gas appliances—gas companies can cash-in handsomely if they will take advantage of this opportunity.

About ten days previous to Thanksgiving Day, inaugurate a special newspaper advertising and selling campaign featuring ranges, aluminum roasters and a complete line of cooking utensils. During this ten-day period make your window display artistic, attractive and symbolic of the Thanksgiving Day spirit.

Reductions in regular prices are not advocated at this time of the year, although inducements to purchase can be offered in other ways. A thirty-day free trial plan has been successfully carried out by a number of companies.

In December a further impetus may be given to the Christmas shopping by deferring the initial payment until January or February. This is a sales policy adopted by many department stores and with the credit rating of gas consumers already established such a special offer should result in many sales which would not otherwise be made until several months later.

During December continue your efforts to sell gas heating appliances. This is the month when need for heat and comfort manifests itself. How many there are who procrastinate in the buying of an overcoat; the same psychology applies in the buying of gas heaters.

Christmas is the ideal time to dispose of the higher priced gas merchandise. A beautiful white enameled range for mother; an automatic water heater and washing machine for friend wife; a set of pyrex ware for the bride; a gas iron for sister. These are but a few of the numerous articles which could be featured during the Yuletide Season.

The Club Plan whereby the various members of the family contribute to the buying of a high class enameled range for mother is an attractive offer which has an appeal to those who are undecided what to select as a suitable gift for a loved one.

Do not overlook the fact that the sale of appliances is a means to an end—*the sale of more gas*. The Home Economics Service Department should be particularly active during this season, particularly during Thanksgiving and Christmas weeks. Do not overlook even the matter of cooking breakfast cereals. Figure what it will mean to increase your gas sales as the result of every consumer cooking a breakfast cereal daily. It is worth trying for. (Note the chart of the U. S. Dept. of Agriculture.)

Good Window Displays Attract Buyers

How often have you gone into a store and bought a piece of fishing tackle, golf equipment or some piece of wearing apparel because you saw it attractively displayed in the window. Of course, you knew about the thing you bought when you saw it in the window, but the sight of the thing you had in your mind to buy some time was the straw that broke the camel's back and made a sale for the store whose windows were attractive enough to arrest your attention.

Window displays cannot take the place of newspaper advertising or the salesman, but they are an invitation to come in and examine the things these two are trying to tell you about. The more attractive window, the more cordial the invitation.

Gas Heating Business

In the latter part of September and throughout the following months, the nights and mornings will be cool, although hardly cold enough to warrant the

operation of a central heating plant. This is the time the gas company salesmen should sell many gas heating appliances.

The warnings recently issued by the United States Fuel Administrator indicate there is likely to be another serious shortage of coal during the coming winter.

The result will be a big demand for gas heaters. If these are not supplied by the gas company they will be available and sold by the dealers, who in many instances, as in the past, are not so concerned with the question of quality merchandise as with quick turnover of stock and large profits. Therefore, as a guaranty towards good service, the gas company should take advantage of the inadequacy of coal supply and push the sale of such appliances. *"LET US BE YOUR FUELMAN"* might be a good slogan for the gas man to adopt.

Effective Window Display and House Heating Advertising

Advertising is effective only when positive and lasting reactions are produced in favor of the idea advertised. In other words, advertising must conduct, convect and radiate REALISM.

During a recent production of the photoplay, "Nanook of the North," the ideas of intense cold, blizzards and general discomfiture were so realistic that people in the audience shuddered and drew their wraps more closely about them, in spite of the fact that at the time the theatre was uncomfortably warm. The idea of the picture was excellently advertised by effective display.

House heating display can be made just as effective. WARMTH, SHELTER, COMFORT AND CONVENIENCE must be the reactions produced upon the subjects. Inasmuch as there are little if any of these qualities in a simple display of cast iron boilers, radiators or radiant heaters, it becomes necessary to so group these appliances with other supplementary ideas that the resulting associated effects produce the desired results. WARMTH is simulated by color properly. COMFORT and CONVENIENCE are augmented by personalities in the group picture,—pleasantness, cheer, serenity, charm and the "general glow of satisfaction."

Gas Lighting Can Be Held and Increased

The majority of people in this country still judge gas service by gas lighting. The effectiveness of your campaigns in selling all gas appliances depend upon what you make your consumers think of gas illumination.

Many people think of gas lighting as old-fashioned. If we could see the fixtures they have in their homes, we would probably agree with them. There has been a "style change," as in clothes, automobiles, and house architecture,

in favor of another kind of home illumination. Gas lighting has to be *sold.* And it has to keep on *being sold.* Let's meet this "style change," go it one better my selling gas lighting all over again with *MODERN FIXTURES.* modern in appearance, modern in the quantity and quality of the light they give, modern in the little attention they require.

Carry Your Appeal into the House

Lighting Fixture Campaigns, recently concluded or at present under way, have proved conclusively that the public is intensely interested in modern gas lighting. They want to be shown the latest developments in gas illumination. And being shown, they buy.

Some Interesting Figures

In New York City in 1922, 17,000 fixtures were sold by the Consolidated Gas Company. In Philadelphia, during a campaign on upright lights, 45,000 units were sold in four months. In all other cities where this campaign was conducted, the proportion of sales to the number of meters ran about the same as in Philadelphia. Other cities in which either semi-indirect fixture or upright light campaigns have been conducted, are

Pennsylvania: Reading, Allentown, Harrisburg, Norristown, Westchester.

Maryland: Baltimore.

New York: Troy, Syracuse, Binghamton, Rochester.

New Jersey: Newark, Camden, Burlington and other cities.

Massachusetts: Charlestown, Salem, Arlington, Quincy and other cities.

New Hampshire: Concord, Nashua.

Campaigns Thoroughly Worked Out

A campaign plan that has been successfully employed in many cities calls for the manufacturer to supply the lights at a given price, provide for a highly specialized selling force, and take care of all details until the light is installed and the first payment made by the purchaser. Then the balance is collected by the gas company, generally with its monthly consumption bills. In some cases, gas companies prefer to employ their own salesmen, who first are trained by representatives of the manufacturer. In either case, as far as the consumer is concerned, the campaign is conducted by the gas company. Its name appears on all advertising matter, and the salesmen introduce themselves as gas company representatives.

Advertising Saves Salesmen's Time

Time is a most important element in the success of each individual salesman. He must be helped in every way by means of newspaper advertising,

campaign circulars, gas bill stickers and wagon posters. Your consuming public must be acquainted with the campaign—then when the salesman calls, he is not forced to waste time introducing himself.

Gas Lighting Assumes a New Aspect

To the consumer who is shown a modern gas fixture in actual operation, gas lighting assumes a new aspect. It is most important in all cases where it is practicable to demonstrate the fixture, to have it lighted in the room where it is to be used. The beautiful appearance of the fixture, the brilliance of its light, the many convenient features, will help materially in closing the sale. Some campaigns have featured a free trial lasting three days. In the vicinity of Boston, many gas companies have found this latter plan to work very successfully. Another gas company, in a small community, employs one solicitor whose time is given over to selling fixtures on the thirty days' free trial plan. That this method of selling is successful is proved by the fact that on these installations nearly 100% of sales are closed.

What Does the Salesman Find?

In previous campaigns, what did the salesman meet? Was his a cold reception—did he find an enemy confronting him? No! In practically every case, it was a somewhat neglected friend, receiving him gratefully. And the old, worn-out lighting fixtures that were jeopardizing gas lighting in that house—that it was his job to replace,—seemed to say "Well, it's about time someone took an interest. We have been trying to uphold the honor of gas lighting for a long, long time, but the odds are against us."

Is it the fault of the gasoline if an old, broken-down automobile stalls on a hill? No, and the driver doesn't think so. But if the gas lighting in a house does not give satisfaction, the householder does blame GAS. That is the situation that confronts us, and it can be, and has been remedied by progressive gas companies.

Campaigns Run for Profit

In conducting these campaigns the gas company, of course, incidentally expects to make a profit. There is no question of doing this if the payments can be collected promptly. In cases where deferred payments are added to the gas bill, the matter of collection is simple. Where this is not done and collectors have to call at the homes, the collection expense eats into the sales profit.

Displays

In displaying fixtures in your windows, make the setting an actual room—living room, dining room, kitchen. Then the consumer can get a real idea of how the fixture will look in his own home surroundings.

Salesroom displays should be so arranged that different styles of fixtures are connected and ready for demonstration. The sales force should be acquainted with the merits of each light, and know for what particular rooms they are best suited. It is most important that the fixtures on display be cleaned and dusted regularly, and that the pilot lights are not allowed to go out because of negligence.

Assistance from the Manufacturer

The manufacturer, who has helped in most of the successful fixture campaigns in past years, is always ready and willing to render every possible assistance. Booklets, circulars, suggestions for advertisements and displays are available. The representatives of the company will help you in planning your campaign and mustering together an efficient campaign sales crew.

The Larger Aspect

Entirely aside from the question of profit on the individual sale, there is a larger objective to be gained. The campaign is helping to preserve one of most important branches of the business and upholding the reputation of GAS SERVICE.

J. E. Davies (Chicago, Ill.): You have all received three or four copies of the sales stimulation recommendations during the past year. I would like to ask which of you gentlemen and companies have adopted the recommendations of the Sales Stimulation Committee during the past year, so that we may determine whether such a service should be continued during the coming year.

The Chairman: To start off, Mr. Davies, all of our companies have adopted your plans, and I would like to hear from some of the other people.

O. L. Maddux (Kingston, N. Y.): While in the south the first part of the year it was my pleasure to conduct three campaigns or three sales programs in line with the plan of the Sales Stimulation Committee as sent out through the Association, and in every single case I found that the realization was a great deal more than the anticipation. I also found that being sold yourself on the thoughts given thereon really helped to a greater extent than I first believed possible.

I think it would be intensely advisable to go through with it, not only this year but in the years to come, looking always toward getting ourselves in a position so that we can go out and push harder to convince the American housewife of the slogan of the company: "It can be done better with gas."

Austin Burt (Waterloo, Ia.): We have adopted, to some extent, the idea presented by the Sales Stimulation Committee. We have obtained very satisfactory results.

J. P. Hanlan (Newark, N. J.): Over our way we adopted the Sales Stimulation Committee's plan, I might say, 100%. Those of our men who are here, know better than I, from their close contact with the plans, that those suggestions enabled them to get business in larger volume than they ordinarily have been able to get. There is no question about that. I think that any man or any organization that did not make use of those plans this year missed a big bet.

Just take, for example, one concrete instance,—the two dollars down sale. We would never have been able to have secured the satisfactory result we did without that one plan. That is just one instance. Our sales at the beginning of the year just moved up by leaps and bounds, simply because we had that one special feature of the plan to offer.

That feature of the plan which suggested an allowance for old ranges,—while it is true we did not take back the number of old ranges we would expect to take back under that plan, did this—it enabled the man who was directing the sales of the man on the street to have something different each month, or each three months, to offer to his customer. It gave him something concrete, something that was generous. And I will say, so far as I have anything to do with it, that if the Sales Stimulation Committee functions next year, we will be very glad to go along with their suggestions, because they certainly were a big factor this year in our sales.

C. A. Luther (Chicago, Ill.): Mr. Davies might hesitate to talk about his own company so I will talk for him. Naturally, Mr. Davies, being the Chairman of the Sales Stimulation Committee, has to practice what he preaches.

I just want to state about Chicago, that on gas ranges alone, we showed very close to 20% increase in the sale of

ranges over last year, and our figures last year were no mean figures. We have run as high as 34% on some of the items that were sold, and we attribute it to following out the rules laid down by the Sales Stimulation Committee.

S. E. Linton (Nashville, Tenn.): We have followed very closely the copies that have been sent out on this subject, and we have gotten wonderful results. We have done a little better than Chicago —we have shown about a 50% increase in our sales over last year, and last year was our banner year up to that time.

The Chairman: That checks up with the Massachusetts Lighting Company which shows a 50% increase over the record of last year, and we have followed pretty nearly 100% the Sales Stimulation Committee's recommendations.

W. B. Johnson (Toronto, Canada): We have not followed the entire recommendations, but we have followed part of them, and we have been very successful with them. The coming year we intend to follow them even more closely.

The Chairman: Gentlemen, I think your Sales Stimulation Committee has probably done more for the Commercial Section in actual work in selling the idea of what the Commercial Section has been instituted for, than any other committee we have had. The selling of ideas to sell the selling idea. That is rather a difficult thing to get at at first. Selling the selling idea—that is what we have got to do to our organizations before they can sell it to the public. And I think we have had comprehensive and constructive thoughts and suggestions laid before us in such a way that we may take them without any effort and work them through with very successful results.

J. E. Davies (Chicago, Ill.): I just wanted to show my appreciation to Mr. Stotz and the committee who aided me during the past year, because each and every one of them gave me 100% assistance, and it was with that assistance I believe that we were able to give you at least some ideas on which you could cash in. We did not believe that you could use them all, but we thought there might be some there that would be of value to you.

SECOND SESSION

Wednesday Afternoon, October 17, 1923.

The Chairman: In opening the session this afternoon it might be well to give a little notice in regard to the first paper, and that is that actual demonstrations are really the best means for selling appliances, as well as ideas. It has been my experience that you can tell the same thing many times to get it over, whereas a visual demonstration of the same idea will get it over almost immediately.

In regard to window decorations, we had the experience in Boston a few months ago of having our entire force in and having a window decorated before their eyes. Immediately our show windows jumped 100% in appearance, so that we have thought it would be well to give you sales managers and sales executives some definite and helpful information by means of this demonstration—"Window Displays as Business Getters"—by Mr. L. E. Lindsay, Manager of the Display Section of the Peoples Gas Stores, of Chicago.

(During the following remarks by Mr. Luther, Mr. Lindsay proceeded to demonstrate the art of good gas merchandise window displays.)

C. A. Luther (Chicago, Ill.): First, I want to state that the appliances that will be shown on the platform this afternoon were so selected that no partiality would be shown to any one particular manufacturer. They were selected by a blind drawer from all the manufacturers of the various types of appliances. So do not think that there is any publicity or advertising connected with this display.

There is another thing that I want to state, and that is that if I allude to Chicago and our windows in Chicago, I do not want you to think for a minute that it is in a boastful way, because I can assure you it is not.

In Chicago, until five years ago, we had not realized the possibilities of good window displays and their importance to merchandise sales. Prior to that, we had the same conditions as exist in a good many other companies. It has been my pleasure to visit many companies and I have been very observing, and that is why I say that the same conditions existed in Chicago as in the other companies.

It is not anything to stop in the smaller city and see a window display that has been arranged by someone in the organization. There is a possibility that they have graduated from the days of the soap box and the cheese cloth, which of course was a wonderful stride from setting everything onto the window deck, and possibly a good many of them have advanced to the point where they have gotten into the use of other materials than cheese cloth. But, unfortunately, there are a good many I have seen personally that still adhere to the old method.

I want to tell you that there is no greater opportunity for increasing your business than through your window displays.

You must admit, or agree with me, that the window is a place where you naturally show your merchandise. Now, if that merchandise is shown in an attractive manner, it is bound to register and create a desire in the minds of the shoppers to possess what they are looking at. If it is not arranged in an attractive way, it is natural that they are not going to be interested in it.

I might liken the window—with apologies to the ladies—to the ladies. A lady will go out, and the first thing that she thinks about is a real, handsome dress or a real, handsome hat or wrap. Now, there is just one prime idea in her mind, and that is—attraction. And not to let the men down, we notice on the boardwalk a good many of our old friends from back home who are sporting canes—some of them know how to handle them and some of them do not. It is simply another means of attraction. They have got the idea in their minds but they do not know how to use it when they swing the cane.

The principal function of a window display, is, first, to attract attention to the store and reflect its general character and business policy; second, to back up the company's advertising, if it advertises in other forms than the windows; and third, to sell the company and its policy as well as its merchandise to the people of the community.

I might, at this time, give you a concrete illustration of what window display means to the merchandising end of the business.

About a year ago, we were called on in Chicago to assist in the refurnishing or redecorating and the installation of proper appliances in a city of 50,000 inhabitants, located in the west. I want to draw a word picture for you of that office as we first saw it. We would not have known that it was a gas office because there was no name on the office to designate what it was, although after a thorough inspection we found two or three letters that were not completely washed off the windows. I suppose they felt there was nobody in the community who did not know where the gas office was.

The exterior of the building apparently had not been painted for twenty years —at least, that was the way it looked. It was a one-story building—a few of the shingles off the roof—and if you stood real close to the window and held your hands alongside so as to cut out the outside source of light, you could distinguish on the inside two or three appliances.

We opened the door and walked in. The first thing that impressed us was the inadequate amount of light that they had inside. After our eyes became accustomed to the darkness, we discovered that there were patches of plaster off the walls. The walls evidently had not been decorated for possibly as long as the outside of the building. We found that about one-quarter of the space in front was devoted to display purposes. There was a counter, extending clear across the office, and the clerical force occupied the space in back of that counter. There was room there for probably ten clerks, cashiers, etc., which they did not need.

Passing through this space, we entered the office of the manager. There was nothing to designate that it was the office of the manager. The same conditions existed in that room as existed out-

side. There was a gas heater connected up that looked as if Noah had brought it over on the ark. If the public had been admitted to the office of the manager they would not have thought that the company as a whole was on a paying basis.

Now visualize, if you will, the transformation that took place. The outside of the building was painted; shingles were put on the roof; the name of the company was painted on the two sides of the building exposed to the public, and the office hours lettered on the door. Decks were put in the windows, the floor was covered with linoleum, and the space occupied by the clerical force was reduced to one-quarter the floor area. Whereas formerly only one-quarter of the space was given to the display of merchandise, three-quarters was now devoted to that purpose, and last, but not least, there were a wonderful lot of new, up to date appliances exhibited. And to give it a little touch of that spring feeling, there were trellises of flowers and vines strung around inside the office.

The manager's office was transferred to a smaller room, mahogany furniture installed, the walls were decorated, refinished and additional and adequate lighting equipment installed.

There was a wonderful transformation. The expenditure on that building, to refinish it in that way, was practically one thousand dollars. The returns that they have gotten, so far, represent a whole lot more. In the ninety days after that office was opened up with this new suit of clothes, they did more business than they had done in a whole year previously. Now, if that is not an actual demonstration, I do not know what is.

But there is something else which goes further—it is the effect on the office personnel. For instance, there was one gentleman connected with the company, in an official capacity, who made the statement to me that, before the transformation took place, when he left at night he was in hopes that he would not have to come back in the morning. Why, his mouth even sagged at the corners, to show you how he felt about it. After the renovation took place, this same official was around there as if he was treading on air, with a smile on his face. He said, "Now, when I go home, I can't wait to get back in the morning."

There was another human phase in connection with this case. The door opened while we were standing in the rear of the office, and somebody came in. We could not see who it was because there were several appliances that obstructed our view, but I heard a very shrill voice say, "Vell, vell, what is going on here?" Naturally, I pictured a man about six foot six, weighing about three hundred pounds. And he kept that up all the way over to the cashier's window, and on his way out. He could not understand what had happened to that place.

When I stepped from in back of the obstruction and sized him up, I was amazed to see that he was the town laundryman, and about that high (indicating about four feet high). They told me that it was the first time that that man had ever come into the office without registering a complaint about his bill. He forgot all about his bill.

That demonstrates just what can happen by fixing your place up. Of course, we all know that a pleasant smile goes along with any display.

Possibly, while I have been talking, you have been watching Mr. Lindsay go

on with his decorating scheme and arrange a display that would be typical for a white enameled gas range. The trim in the back of the window has naturally got to cause a contrast between the white of the gas range and the back of the window to bring it out forcibly in front of you.

The material on the side is Venetian cloth.

Now, in speaking about the various kinds of drapes, there are some companies that can afford more expensive set ups and decorations than others. But there is always one thing to keep in mind—that if you are going to put a display in your window, you want to pay particular attention to your background, because, when all is said and done, the background is a most important part of the display.

I do not know of anybody who is more critical than my wife. I have had my wife go down in front of the windows of the gas building and then tell me how poorly they were fixed up, when I thought they were magnificent. But she discovered certain little things, for instance, the seams of the cloth, the drop stitchings that might occur in the stitching of the cloth, and the various ways it was draped.

But we feel now that we have gotten past that, and we are getting more perfect, thanks to Mr. Lindsay's department.

It was not many years ago if anybody spoke about taking a gas range and attractively displaying that mass of iron and steel we figured it was practically impossible. I think you will bear with me that the window that you have just seen, with the gas range setting in it, is comparable to many of the window displays of our most progressive merchants. The idea of the drapes is just the same as the lady with her beautiful engagement ring with a platinum setting to throw the diamond out—it makes the diamond look larger, it projects it into the minds of the people who are viewing it.

An interesting incident came up yesterday that really gratified Mr. Lindsay. I know it pleased me, and I know it pleased the Association and the representatives of the Commercial Section. That was when the representative from Lebanon made his speech of acceptance and stated that he gave a certain amount of credit for their success in the Sales Per Meter Contest to the Sales Stimulation Committee. It showed that somebody has been paying attention to the articles and the pictures showing various window exhibits that have appeared from time to time in those sales bulletins.

Mr. Vincent, at the meeting yesterday, stated that he read an article which predicted that in the future the furnace room would be rid of its dirt and grime and that it would be turned into a kiddies' playroom or a work room.

We have one window that follows out Mr. Vincent's thought of the transformation that has taken place in the furnace room. The walls are highly decorated in a child's color scheme. There is a little table, miniature pieces of furniture and a couple of doll babies—and the other little touch of human interest, a little teddy bear that has evidently fallen down, with one foot stuck up in the air.

I want to tell you that a large number of people stand in front of that window and the teddy bear is the thing that strikes their eye first. Coming up the street they see the teddy bear—cannot understand what it is doing there—and

then they gaze up further and notice the transformation that has taken place, particularly after reading the signs that describe everything in the window. Too much stress cannot be laid upon that little personal touch in the window.

Another powerful factor in window display, upon which too much stress cannot be laid, is the proper display of cards or reading matter that go along with the display. The statements that you put on these cards are just as strong and convincing arguments as a salesman can give to the customer. Very careful attention must be given to those cards as the misspelling of a word or the improper use of a certain phrase might create embarrassment.

Now as to picking the proper man to handle your display work. I say "man" with all due respect to the ladies, because there are lots of heavy things that have to be moved from time to time, and in some of the smaller companies the man power might not be able to assist at the time it is needed.

Too much attention cannot be given to the person selected. Now, by that I do not mean that you have got to secure the services of an expert or a man of national reputation, or of local reputation. But in selecting a man in your employ, there are a few things that you should look for. He should have certain qualifications to fill that position. The most salient qualification, in my mind, is that he must be a salesman. He must know his goods, because, when all is said and done, that man is functioning as a silent salesman to sell the goods from the inside of the window to the customer who is standing on the outside. Salesmanship really goes hand-in-hand with window display.

He must have common sense. He must have enough gray matter to figure out contrast and the type of appliances and the angles, etc., in which to set them. If you have a man with those qualifications, I am satisfied that he has got a very good start as a display man.

Allow your display man to travel around and see all the various windows and how they are decorated. If a man has the salesmanship instinct, common sense and ability to visualize, he can stand in front of another display and visualize, in his own mind, how much better he can fix up his own window, and then go home and do it.

I just want to state, in conclusion, that a store window is 100% advertising—that there is a very strong similarity between advertising and window display. Both are a means of communication to the public. If a window display could be put on wheels and moved all over the city, then there would be no necessity for newspaper advertising. But that being impossible, we require the newspaper publicity to bring the people to the windows.

The Chairman: To my mind, this proposition of window display is one of the most important parts of our program. Everything that Mr. Luther has said, we absolutely stand back of and recommend for your honest consideration.

Member: Could we get from Mr. Lindsay a few remarks about the materials used and what he finds to be the best cloths to use?

L. E. Lindsay (Chicago, Ill.): The material used is what we call "spider silk." It is a cheaper grade of material, 36 inches wide, and it comes in any shade that you may want. However, it is not sunfast. It will fade. But it can be dyed, and that is really a good feature, because it changes your color scheme.

You do not have the same color for every setting you make. This material costs a dollar a yard. With our buying power, we pay 90 cents a yard for it. But it is good wearing, and we use it right down to the last fibre. It can be used and re-used. If you have a firm in your town who can clean and dye, you can re-use this material.

We have been in the habit of using a velour. We use this (indicating) for plateaus, drapes and different things. It is really the cheaper grade of material but it is very substantial. It is not sun-fast. This piece (indicating) has been re-dyed twice. We take a large piece and cut it down into a smaller piece of covering for a small plateau so that you are effecting a considerable saving by using this material over and over.

We have shown a large variety of colors here that are quite contrasting and in keeping with the merchandise displayed. This (indicating) is in keeping with brown and gold, and such effects. For white enamel, nickel plating and such, we would use the purples and blacks. If we are displaying a black range, we have a lighter background. The contrast is what you are after.

(A rising vote of thanks was extended to Mr. Lindsay for his very interesting and instructive demonstration.)

The Chairman: The next subject on our program is a paper, "What Makes Your Holder Go Down at Night?" This is a particularly important subject, more so for the smaller companies than for the larger companies, but one that is of much importance to the larger companies.

We have had a great many problems to take up in the commercial side in regard to load factor and the distribution of our load, and the hours, the months of the year, etc., and we still have with us, every day, every season of the year, the fact that our holders go down at night.

WHAT MAKES YOUR HOLDER GO DOWN AT NIGHT?

Jacob B. Jones, Supt. and Treas., The Bridgeton Gas Light Company,
Bridgeton, N. J.

It is fairly safe to assume that the greater part of the industrial load goes off after dark.

In the homes "dinner has been served" or "supper is over"—according to the size town you may happen to be in. The last meal has been prepared—the dishes washed—and the usual domestic work finished.

This leaves us with just about one good reason for our holder going down at night, and that is—the use of gas for lighting.

It is true that present day entertainment takes many folks from their homes in the evening—but it is equally true that the very great majority of our consumers stay "right at home."

Father still has his pipe and his paper—mother the usual batch of mending—and the children their games and studies.

The kind of illumination they are using will bring forth some very interesting side-lights, if you care to take the trouble to find out.

My suggestion is to try walking your mains after dark. You may say this is impossible or out of the question.

I know of one manager, whose company has thirty-five miles of main, who has consistently done this for the past five years.

He wanted to know just why they were losing certain lighting business and determined to find out by going over the city and seeing for himself.

Starting early in October, he used every spare evening until March—covering the streets served by his company.

He found many instances where the gas lighting could be improved and a service car was sent to the house the next morning. The trip also developed many new prospects and a solicitor was immediately on the job. The consumer did not know why the service man or the solicitor called, but they were always welcome.

These walks soon convinced the manager that he needed a trained man to cover the city regularly and inquire if the gas servive was satisfactory, and to devote his principal efforts toward gas for lighting.

Soon after starting the plan of calling on all consumers, it was found that modern gas lighting units could be installed to replace worn out and obsolete equipment, if some inducement was offered.

After considering several plans—they adopted the one of making a flat allowance, and a liberal one, for all old lighting fixtures and installing a new and modern semi-indirect fixture on 30-day trial.

Once the old equipment was out of the house and the new fixture in place for 30 days, the sale was practically closed.

There seemed to be a bit of psychology about this thirty-day free trial that made friends—and made sales for the company.

In walking the mains, this manager found, that in the so-called exclusive section, his company was selling practically no gas for lighting, and strange as it may seem, while the houses were lighted throughout, there was apparently nobody home.

While on the side streets and the streets with the more modest homes—fewer rooms were lighted—but they were occupied—folks were living there—and they were using gas for lighting.

Among the interesting facts which he learned on his walking trip, was the surprising number of folks who used gas for a reading light, while some other form of lighting was used for general illumination.

This manager that I refer to, picked up all sorts of business that was profitable to his company and a very easy load to handle.

For instance—every jeweler in that city has a No. 620 Reflex Lamp just above his safe—where it will illuminate the certificate of the Jewelers' National Protective Association—that burner is in use from 5:00 in the afternoon until 8:00 the next morning—fifteen (15) hours of steady consumption.

This night light idea so appealed to him that he went to the merchants and offered to install night lamps free—pointing out that one single lamp in the rear of their place of business would so light the store that nobody would take a chance of entering.

Then to clinch the idea, he went to the police commissioner and suggested that gas never went out, and if a light was not burning there must be something wrong.

Folks are used to other light failing, but for the gas to be out meant something out of the ordinary.

The commissioner gave orders to his patrolmen to make a special investigation where they found a night lamp out and then call the proprietor on the 'phone, and more than once they have called some fellow out of bed and directed him to come down and light the burner, which he had innocently forgotten.

This manager also had a way of dropping in bake shops, milk depots, produce stands and places that were operated either all night or began work very early in the morning—where every minute counts and to be without light was vital. He sold them gas for lighting.

This town is not an isolated case—there are many cities where a steady and sincere effort is being made to retain the lighting business.

The general statistics of the gas business compiled at the A. G. A. Headquarters for the year 1921, show that sixty (60) billion cubic feet was sold for gas lighting.

From other figures we learn that—60,000,000 gas mantles were sold last year, and that one (1) company alone sold—

431,000	Upright Lights
357,000	Inverted Lights
167,000	Upright Burners
418,000	Inverted Burners
4,000	Arc Lamps
2,500	Pendants
30,000	Semi-Indirects (inc. dining room styles)

They all help to make your holder go down at night.

The Welsbach Company has prepared an exhibit showing the fixtures and burners which have practically become standard with the companies who have gone out to increase their lighting business.

These fixtures have not been designed for the exclusive home—that demand special lighting effects—they have been designed for the great majority of our consumers who live on the residential and the side streets—and from whom we derive our principal income.

Some of you gas men may feel that gas lighting is more or less of a dead issue, but that does not necessarily reflect the viewpoint of your customers.

You may be selling gas for lighting in spite of yourself.

Good gas lighting helps you in the sale of other appliances. You all know how much gas you sold last winter for auxiliary heat and you know how easy that business came.

Do you know how much business you lost because the house was not piped above the first floor?

I have heard it said—"we want to hold our lighting business, but our salesmen just will not push it."

Neither would any of us—if we were working on a straight commission. Certainly the salesman would rather sell a $60.00 range than he would a $20.00 lighting fixture—but, pay him an extra commission on all lighting business—you will soon see him go after it.

It is true that it costs more to maintain good gas lighting, than it does domestic or industrial equipment. However—mains, services and meters cost money to maintain if they are only working part time.

No company would think of installing plant equipment that was only used during the day light hours—yet they allow street mains to lay idle—when they can be kept working after dark.

To my mind, the expense of maintaining good gas lighting is more than offset by the cost of having idle mains.

I believe that the ideal of every gas man is to have an evenly balanced load throughout the year. For that reason we have pushed the sale of the water heater and auxiliary house heating, and it is fine business—an outlet that is bound to keep on increasing every time that the price of coal takes a jump.

If we balance the load throughout the year, surely we should put forth every effort to balance it over the twenty-four hours.

I venture to say that eighty per cent of the companies represented in this convention are operating under charters designating them as gas light companies.

That many companies putting forth a one hundred per cent effort for gas lighting, will hold for the gas industry its greatest publicity asset—and for their individual companies—supply an outlet that will keep all equipment working the maximum day hours.

For the purpose of creating discussion, I would like to ask the gas men here assembled, these questions:

1. Do you believe enough in gas lighting to use it exclusively in YOUR OWN HOME?

2. Do you give the same space to modern gas lighting fixtures in your showroom that you do other appliances?

3. Do you really furnish good maintenance service for the lighting business you now have?

4. Can the gas industry as a whole afford to lose its identity in the lighting field?

One morning I went into our plant and the holders were much lower than I cared to see them for safety's sake. One of the boys noticed that I was anxious and he same over and said—"Boss, you can't make any money if the holder stays up all the time."

That is the one big reason why we like to see the holder go down at night.

Mr. Stetser, of the Welsbach Company, is going to tell you something about those fixtures, in his own way.

After Mr. Jones read his paper, the Chairman called upon Mr. J. R. Stetser of the Welsbach Company who gave a most interesting and instructive demonstration of the various types of mantle lamps and fixtures, explaining the proper and improper method of handling mantles, and adjusting burners to get the best results.

The Chairman: I do not think that I, as chairman of your Commercial Section, can let this opportunity go by without just saying one short word in regard to gas lighting.

Gas lighting founded our industry. It is because of gas lighting that you and I, here this afternoon, have our livelihood—the same as electric light developed the electric business.

Anybody who has any commercial instinct should not be allowed to be called a salesman or a gas man who would allow an opportunity to sell go by. And we all have, in every one of our companies, a definite chance to sell gas lighting. It does seem to me that we owe that duty, not to the Welsbach Company, but we owe it to our gas companies and our stockholders to take care of this gas lighting business that is available—not by some magical process to get some business which is not at hand, but to get the business which is waiting for us. The only thing that prevents us from doing that is the lack of desire on our part to get it.

DISCUSSION

J. P. Hanlan (Newark, N. J.): I do not look upon this proposition from the gas company standpoint as much as I do from the customer's standpoint. I claim that the customer's service is not complete unless it takes in gas lighting service. In other words, if the gas lighting service is not right, that customer's service is only a partially complete one.

I have always been in favor of gas lighting. It is a beautiful light. As I sat here today watching Mr. Stetser and his demonstration, I could not help but look back and realize what a difference it would make in this room if it were gas lighted. You can appreciate that if you try to read with the light we have in this room. Of course, if this was gas light we could criticize it, but due to the fact that it is electric light we cannot say much about it.

In the past year we have had a number of lighting campaigns and in those campaigns I believe we were very suc-

cessful. We have not taken all the credit ourselves, and I want to give the Welsbach Company credit for making the campaigns the success they were.

I have not the figures here—and the figures would not be worth while if I had them—but the fact remains that in these various districts where these campaigns were carried on they were successful, and we have improved the lighting service to those customers. It means that those customers are getting what they are paying for, and if we gave them less we would not be doing our full duty by them.

The customer is entitled to the best service that gas can give him for any purpose, and if we do not at least try to induce the customers to perfect their equipment so that our service can do it, we are to blame—nobody else.

There is another side—the company's side. The company, of course, wants satisfied customers. They want customers that are more than satisfied—they want pleased customers. They can have pleased customers or they can have dissatisfied customers.

I have heard some gas men say, "Oh, well, if we do lose the lighting business we will make it up in this way, or that way." You never can make up good will. I do not think it is possible to make up good will.

I notice in our own company that as our lighting business is decreasing, so is our heating business decreasing, insofar as auxiliary heating is concerned. On a day when ordinarily we might expect to sell fifty gas heaters, we sell perhaps twenty-five, because the people who might buy the other twenty-five heaters have no way to use them. And therefore, our market is limited to the sale to those people who have gas in their homes and can use the heaters that they buy.

So, if you lose your lighting business, you are going to lose a great part of your heating business, notwithstanding what everybody tells you about getting so much of the other kinds of business. I find, after all is said and done, that no matter how good your commodity is, or no matter what you have got to offer, it has got to be sold. I do not think that people are going to be running after us to do certain things, because there are other people who have a similar service to offer, maybe electricity, maybe gas. We ought to look at our business in its entirety and try to insure the maximum of service to every consumer.

The Chairman: The problem of gas lighting is much more difficult in the larger cities than it is in the smaller cities. It is a much easier proposition to continue and keep your gas lighting in the smaller towns than it is in the larger ones, and as Mr. Hanlan is a representative of the large city, I would like to see if the same holds in another big city—New York. Therefore, I would like to have Mr. Karshner, of the Consolidated Gas Co. of New York, say a few words in regard to gas lighting.

G. M. Karshner (New York, N. Y.): This subject is very interesting to me. Five or six years ago in our big city, we were allowing our gas lighting to drift, and one of our executives, a man of vision, stopped us with a jerk. We were working on the larger business, industrial, hotel, and other things, and we decided we had better get back and go to work on gas lighting. We started and in the five or six years we have been actively pushing gas lighting again we

have made increases that are almost phenomenal. This year I think our sales will approximate $600,000.00 on fixtures such as you see here, mantles, glassware and other things.

For the sake of giving the customer the right kind of gas service, we have a large Maintenance Department, the members of which go out on call and sell mantles, glassware or any other sort of lighting accessory at a retail price, the company doing all the labor free.

We feel that we are giving a complete service. We can see now that, before we were doing this, the man who had poor gas lighting in his home did not think so much of his gas range or water heater, and did not think so much of our company policy. But now he knows we are taking care of him, and every customer knows that he can call us up and we will go and make his lighting just as perfect as possible. And we find it pays.

There is no question but what in any city if you hire a few men to go out and sell gas lighting they can sell it. We have forty men on the streets of New York today, canvassing for a new fixture that we have. Those forty men are selling from 90 to 110 and 115 fixtures a day. In addition, we have a large force of men who take care of the customers, and pay their way on the retail prices of the equipment they sell to the customer. The customer is satisfied and we are making money.

Just one other thought. We are all anxious to make our gas appliance department show a profit. In the last few years we have been trying to show our gas company management that we can conduct that department and, besides rendering good service, that we can also make a profit in selling appliances from day to day and from month to month and from year to year. And we can certainly make a good profit in this gas lighting game. Put your price right and pay your men a good commission. Our men are on the job, make good money, and we are making a nice little profit from our lighting division, besides giving good service and keeping gas sold that we had been losing steadily.

We are trying our best in New York to give the customer a good lighting service so that he will keep using gas as long as possible.

The Chairman: That shows, gentlemen, what can be done with gas lighting in the large cities where the problem is much harder than in the smaller towns. Therefore, if it can be done in the large cities it certainly can be done in the smaller towns, and if you do not get it, it is your own fault.

Our time is limited and we must proceed. But before doing so, however, I thank Mr. Jones, also Mr. Stetser, for the beneficial talks that they have given us here this afternoon.

The chairman next called upon Mr. Philmer Eves to report upon the work of the Committee on Home Service and to present his paper on "Home Economic Service in its Relation to Gas Sales."

Philmer Eves (New Haven, Conn.): Before proceeding further, I would like to say, briefly, what progress the Home Economics Service Committee has made during the past year.

As you know, this committee was appointed a year ago and has been functioning and has been a busy body. Not only have meetings been held, but a complete, illustrated report has been made and circulated among the gas com-

panies, and you will be anxious to know with what effect.

Now the summary, compiled from replies received by the committee to the questionnaire sent to gas companies, shows, in condensed form, the effect of the effort to induce gas companies to adopt the Home Economics Service.

The summary shows that of those who replied fourteen gas companies now have Home Economics Departments in operation, or are busy installing them. Thirty-one companies are interested, or have expressed an intention to establish Home Economics Service. Thirty-nine companies are considering this proposition but have not yet decided. Two, only, have flatly turned down the idea, because their companies are small, and they do not see their way clear to establish this service.

The above showing indicates a decided and gratifying interest in the movement, and warrants the belief that at this convention there will be an overwhelming vote in connection with Home Economics Service.

Home Economics Service, in its relation to gas sales, is perhaps a very important topic.

HOME ECONOMICS SERVICE IN ITS RELATION TO GAS SALES

Philmer Eves, *Chairman,* New Haven, Conn.

In the report of the committee appointed last year, Home Economics Service in its relation to goodwill and friendly relations with the gas company's patrons was fully dealt with. In the same report recommendations were made for the benefit of gas companies contemplating the addition of this service to their cooperative and educational activities. The Association suggests that it might now be advisable to say what could be said for the service as it affects gas sales.

Gas sales that might be considered the consequence of home economics service cannot of course be unwelcome in any gas company's sales department. Any worthy means that will increase sales of gas and appliances may be deemed to be part of every gas company's business policy. That this service of a home economics department is one of these honorable means of bringing about gas sales will be admitted by any one who has had the slightest experience of this service. Home economics service, by whatever favored community it may be enjoyed, must inevitably be a contributing cause of the adoption of the modern conditions in the home which the service inculcates. The use of up-to-date, efficient appliances is an essential part of home economics. Obsolete gas ranges and old time gas water heaters must be replaced by the newer and more practical appliances advocated in the service.

The desire of gas companies to cooperate with their patrons in establishing and maintaining these better conditions is the result of an honest business impulse to give the highest type of service. The great reward that is considered of paramount importance and value, however, is the asset of goodwill. "We must count as our most valuable asset the goodwill of our customers. The most earnest efforts should be directed towards deserving and maintaining this asset." All gas companies feel it is not a mere duty but a guiding principle to help their patrons to get the highest service. This, however, not only brings about goodwill but its influence is felt and seen in the sale and extended use of the company's appliances and commodity.

The extent to which the increase in the number of modern appliances installed and in the gas used is brought about cannot be gauged. There are so many other contributing causes and these are so intertwined and inseparable that no statistics claiming all the credit for sales can be correctly compiled. For example, there is the advertising, the canvassing, the campaigns and the inevitable sales that are created by attractive window displays. Then there is the increase of business resulting from

the natural growth of population. There is also the effect of the high regard for the company established during long years of uninterrupted and honorable gas service. We must also consider the sales and the increasing output that can be traced to local stockholders who support the company in which their money is invested and the sales that might be found to arise from other probable and possible relations.

But assuming all these various sources, we have found from long years of practical experience that home economics service is one of the most visible and inevitable causes of the company's growth and development. As an instance of this service, during only six recent months of the operation of the Home Economics Department of our company in New Haven, 3377 women attended the free cooking demonstrations. These women and thousands of other women have for years been taught how to bake cake, pies, bread, cookies, biscuits, waffles, muffins and other things that they would otherwise not think of or adopt for their families. This must mean in the aggregate an enormous quantity of gas used to say nothing of the number of higher class gas ranges and water heaters, toasters, waffle bakers and other appliances sold. Cereals cooked with gas in the homes of these people for breakfast instead of the package breakfast foods on the markets must mean additional gas consumption. Mrs. Peterson of Chicago says that if a family which has been in the habit of serving a package food can be induced to serve oatmeal which is more economical and than which there is no better food for growing children, by this one small change in their cooking habits, an increase of seven feet of gas per day is gained. This alone amounts to 200 feet per month or exactly 8 per cent of the average family's consumption.

The same high authority asks this pertinent question, "Can you increase sales of gas by a greater interest in cooking?" The question is answered by the statement that 20,000 women attended her lecture demonstration in 7 months and by the fact that these thousands of women were willing to be led to a greater interest in cooking. These women soon acquire a very kindly feeling of gratitude to the gas company. They not only become better paying patrons but they are more likely to remain users of gas. Take a concrete example. A lady in our territory said to the writer over the phone, speaking of a recent meeting in our company's assembly hall, "Father Carver spoke of your company's kindness in allowing the use of your hall for our supper to the Civil War Veterans. Your company is becoming very popular. One of my neighbors said to me, 'You can have electricity put in now and you could have an electric lamp.' I said, 'The gas company has many nice lamps and the gas company was very nice to our Relief Corps.' I told her I should not change to electricity."

All the women attending our company's demonstrations have to pass through the attractive salesroom to the assembly hall. They see the modern gas ranges, semi-indirect and other gas lighting fixtures, attractive glassware, up-to-date table lamps, floor lamps and chair lamps, the latest types of gas water heaters, and alluring radiantfires glowing with warm comfort in their season. Mrs. Peterson pithily remarks, "The first point of contact in getting them to become purchasers is established." The Home Economics Department thus accounts for the sale of many

appliances of all kinds and for the use of more gas.

Mr. Percy Young bears out the statement when he writes of this service. "The splendid accomplishments of this Bureau have been of great value to this company. The work it is doing provides one of the very best points of contact with our consumers that we have and its results are far-reaching." The same high authority in his comprehensive paper on Sales Development says: "More attention should be given to the development of domestic science departments. The employment of well-educated women is suggested, preferably graduates of domestic science schools, who are qualified to speak to women's clubs and schools on the use of the better grade of appliances such as the heat regulator ranges, storage water heaters, gas bathroom heaters and radiantfires. These women would be of great help in broadening the market for gas and incidentally in fostering better relations between customers and the company."

Mr. T. V. Purcell, Secretary of Peoples Gas Light & Coke Co., Chicago, writes: "It would be a hard matter at any time, to give a definite or even an approximate figure on increased gas consumption due to new activities in home cooking. But what 'home cooking' can amount to in gas consumption is well illustrated in our gas send-out chart of last Thanksgiving day. In one hour, noon to 1 p. m., it ran up to 9,299,000 cubic feet, and in the four cooking hours, 10 a. m. to 2 p. m., it was 34,808,000 cubic feet. Under ordinary circumstances this figure would probably have been around 16,000,000; so there can be no doubt that increased home cooking activities must result in a corresponding increase in gas consumption."

Miss Ada Bessie Swann, Director of the Home Economics Department, Public Service Gas Co., writes: "I am unable to give any figures but I know that the company feels that the value of this department is manifested every day more and more as time goes on. The sales of our appliances and the satisfied customers are the only proofs we have."

Now let us speak especially of the missionary work accomplished by the women of the home economics department who visit the homes and remedy the wrongs there. Old gas ranges that have not been used except perhaps for boiling the kettle and doing a little frying are seen to be no longer profitable either for the customer or the gas company. These people are tactfully advised and assisted and many sales are the result. In other kitchens where there are more modern conditions the housewife and the cook are taught to use their gas ranges more fully, to broil and bake at the same time, to utilize the ovens to their capacity and thus are brought into the list of the thousands of customers that do more and better cooking, serve more nourishing and the right kind of foods to their families and in doing so use more gas. When we look upon the sales of gas and modern gas appliances as helping to bring about these desirable conditions we have a feeling that not only are we securing business for our company but that our customers are receiving the instruction which they so gratefully appreciate and which brings to them not merely the kind of service which modern business demands but the uplifting influence of better home conditions. Think of the inevitable effect in the sales of gas appliances and gas by this cooperation with consumers in their own homes. The domestic science graduates who do this

educational work for our company have given more than ten thousand individual instructions during nine recent months. Gas ranges out of order were adjusted, broilers and baking ovens out of use were started up, many old types of ranges were displaced by the later styles. This systematic house to house instruction is going on all the time. It is an absolute fact that the sales of gas are materially influenced by this deeply valued free service.

The service which brings about the proper adjustment and use of appliances and results in friendly feelings towards the gas company must also have its beneficial effect in materially reducing the number of people coming to the complaint department. The women instructors become so familiar with the well-regulated burner and the proper blue flame and are so experienced in manipulating the burner mixers and making the necessary adjustments that this part of their work alone prevents many complaints being sent in to the company and takes most of this adjusting work from the fitting department. The faulty adjustments are mainly found on old ranges which have been in use a number of years and have become clogged or otherwise out of order. Nearly four thousand of these burner regulations have been made by the women of our Home Economics Department during the nine months of the present year. And while the expense of this home economics work is surprisingly small for the results obtained some of this expense has of course cut down the expense of the complaint and fitting department. It also costs much less to secure the proper working conditions of gas cooking appliances when the instructors do the work because they go from house to house systematically. It is also realized that the greater use of the appliances thereby secured brings additional revenue that could be credited against the complaint and maintenance expense account.

The cooperation of the Home Economics Department with the cooking classes of the public schools is another of the agencies which bring sales. The gas company's experts send the message to the mothers of the pupils, "the little housewives of the future," and better kitchen conditions and the adoption of modern gas cooking appliances are the natural result. Miss Luella M. Fisher, the director of the department at Cleveland, speaks of these students as the "future buying public and the advertising medium to their parents."

Another branch of home economics work is the teaching of canning and preserving fruits and vegetables through the season. Here we can offer some persuasive evidence of the influence of the department on gas sales. When the National Commercial Gas Association in the summer of 1917 issued folders and display posters on canning our company purchased and distributed 85,000 of the folders and displayed 400 of the posters through our Home Economics Department. What was the result? The manager of one of the department stores reported that the interest in canning thus created was seen in the phenomenal sales of 4,500 dozen glass jars besides other canning requisites. The bulk of this work of conserving food was done on gas ranges and the additional sale of gas must have been very marked.

There are the free press notices which the editors of public newspapers gladly publish. In our city alone 466 of these attractive, readable and popular items have been published so far this year.

These tell of the home economics service, what it is doing, how it is growing in popularity and usefulness and how the women and many public organizations of the city are supporting and appreciating it. They give the programs of demonstrations and help to bring up the attendance, which a week or two ago reached 378 women. All these features of the department must have a very desirable relation to gas sales.

Then think of the influence in gas sales by the cooperation of the home economics department with the many philanthropic, church, industrial, fraternal and benevolent clubs and organizations. It is incalculably beneficial to have these representatives of so many branches of the public sharing, enjoying and acknowledging the gas company's free service. Apart from the gas business that comes from the members of these organizations there is the effect of their own announcements in the public press and of the potent advertising which this gives at no expense to the gas company.

It is now the hope of the committee that there will be an overwhelming feeling in favor of this service throughout the gas industry and that there will soon be a Home Economics Bureau at Association headquarters to direct and expand this agency. I believe it will be one of the most desirable and profitable departments of the Association's most progressive, helpful activities.

The writer has had a strenuous year in supporting the Managing Committee in its commendable effort to develop this paying activity. The members of the Home Economics Service Committee have also devoted their valuable time and thought to this work. The matter is now left in your hands. From the favorable replies that have come in from gas companies all over the country there can be no doubt that Home Economics Service will be unanimously adopted.

I might add just a word regarding the intentions of the Association, so far as I am able to gather them now.

I think it is considered desirable that this Home Economics Service Committee shall function for another year. I agree with that. I would like to see the bureau established. I agree with the wisdom of these men who would rather get the Home Economics Departments established before we have the bureau to direct it.

And now that it is no longer a matter of urging gas companies to establish a Home Economics Department, but rather a matter of helping them, these inexperienced companies, to operate them—it seems to me, therefore, and I am sure you will agree with me, that it would be extremely desirable for this Managing Committee to appoint a committee to function during the year, with a lady chairman, one experienced in home economics service, and if possible, one connected with the gas business. I have thought of these ladies—there are a number of them—they are on my committee—but it has been suggested, and I have finally agreed to the idea, that it might be advisable, in the interests of this Home Economics Service, which we must allow nothing to jeopardize, to have a lady resident near the headquarters assume the chairmanship. I am therefore much pleased, if I may be allowed to do so, to propose that a recommendation be made to the Managing Committee that in appointing this Home Economics Service Committee, Miss Ada Bessie Swann, of Newark, N. J., be asked to take the chairmanship.

(Upon motion made and seconded, the members endorsed the recommendation of Mr. Eves concerning the appointment of Miss Swan to head the committee for the coming year.)

DISCUSSION

Mrs. Anna J. Peterson (Chicago, Ill.): Just what I might say here would probably only add to what Mr. Eves has already said. As Director of the Home Service in Chicago, it is difficult to say just how much gas we sell. I know we do sell it. I do not think—I *know*.

Our service is a bit unique. We teach the women to want to work, to want appliances, to want to cook, by educating them in their own service, by making the homes livable, making their families well and healthy and strong.

To create a demand to do something in the individual is the highest standard for every Director or Assistant of a Home Service Department, and that is our object, and we are doing it all the time. It is splendid to do it, because we have our head that works with us, who is easy to work with, and I am delighted to know that I have gotten into this service while it is new. It is so nice to be able to convince men that a woman's work is not just fun—it is an art to make a real home for men.

Mr. Luther referred a while ago, in his address, regarding hats or dresses for women. Well, I take objection to that, because I look at real things, like cabbages or carrots or something that makes you "peppy" with snap and dash.

And that is what we get in the home service. A cabbage cooked 45 to 50 minutes is just like eating the end of your hat or the heel of your shoe—no good—and it takes you all month to get rid of it. In the home service you are told to cook it seven minutes, and no longer. That is home service. Then you eat with your mouth and kick with your feet.

Miss Luella M. Fisher (Cleveland, Ohio): Mr. Eves referred to me in his report, in speaking of the children.

Being formerly a school teacher, I will admit that is one of the features in our home economics service work that I especially like.

But in natural gas territories we have a few things different from you artificial men. Just reviewing briefly my school work, the first thing I endeavor to do is to show a picture story of natural gas in the auditorium of the schoolroom. In one of my schools in one of the smaller towns I had 700 students that saw the picture. From that I connected up my appliances in the science laboratory. The physics, chemistry, science, domestic science classes were all sent in to me for the regular period of 45 minutes, and at the last session in this particular school, the science teacher came in and said, "Miss Fisher, have you finished?" I said, "I think I have covered all the students." He said, "We have arranged to have you take up household management. I want to have you tell them something more about the choosing of water heaters."

I do not think I can say very much more. As long as the human power is generated through oxygen and minerals, you men are always going to like cooking, and that is the way we hope we are going to win you over to have Home Economics Service Bureaus in every one of your gas companies.

(Mr. Eves was extended a vote of thanks for his able report and paper.)

THIRD SESSION

Thursday Afternoon, October 18, 1923.

The Chairman: The first part of our program today was left over from yesterday. It is a paper on "Creating a Market for Gas" by Mr. A. L. Crane, Publicity Director, of San Francisco, who has come here to represent the Pacific Coast.

After attending the various sessions of this convention, I believe we realize that we have all got our minds upon the one big subject—creating a market for gas.

I think that you who were here yesterday and saw the remarkable window display demonstration, appreciate that that is one of the important sidelights towards creating a market for gas.

You and I, unless we are very careful, might be conservative enough to feel that, "We have a market for gas, so why all this hullabaloo about creating something which we already have?" In all commercial enterprises, unless they are on the verge of decay, they feel it absolutely necessary to go on creating a little bit more demand for their product as the months and the years roll by.

There are so many sidelights, there are so many phases of this one subject of "Creating a Market for Gas," that I do not know where they stop. Public relations, perhaps, is the fundamentally important thing toward creating more of a demand for gas. As Mr. Gadsden said this morning, with all your printed words, honeyed words, if there is discourteous treatment of your customers by your employees, all that advertising costs you money.

I am now going to call upon Mr. A. L. Crane to give us his illustrated talk as a direct message from the Pacific Coast Gas Association, and I know that we will all be interested and we will be well repaid for our time.

CREATING A MARKET FOR GAS

A. L. Crane, Publicity Director, San Francisco Furniture Exchange, San Francisco, California.

First, I want to, in the name of the president of the Pacific Coast Gas Association, thank your officers and your chairman, Mr. Gould, for the privilege of placing our plea before you, because it is in the nature of a plea.

I am going to take the time for a moment to give you an outline of how I came to be connected with this—because I am not a gas man, I am an advertising man.

In 1915 and 1916 I was privileged to attend the conventions of the Pacific Coast Gas Association and listen to their discussion. I was there in the hope of learning something that would help me in my work—and I found that in almost every case the emphasis was placed upon how they made the gas and not upon how they distributed it. All the attention in the gas conventions was given to making the gas and there was nothing said about the distribution, the matter of selling it.

So we called the attention of the officers to that, which we thought was a mistake, and as a result in 1917 I was placed on the program, and I made a straight-from-the-shoulder appeal for dealer co-operation.

This is a composite picture of the delegates at the convention. I did not have but one friend on that floor. He got up and said he thought that if there could be a method devised of bringing the dealer into closer co-operation it would greatly increase the sales, and he made a strong talk in my favor, but every other delegate was against it.

Mr. John Britton, whom some of you probably knew, and who was at that time the president of the Pacific Gas & Electric Co., sent for me three or four weeks later, and stated that he thought there was a great deal in that and he was going to try it. He said, "There is only one man in my organization who will be friendly to this, but I am going to try it." And he did, and it was a phenomenal success.

There was one little point brought out which seemed to appeal to Mr. Britton. I do not know whether you are troubled with the same thing that we are in the west—that is the professional politician. We are, all of us, out there, more or less troubled with that—the public service corporations particularly so.

I brought out to Mr. Britton the point that by annexing the dealers as a part of his company and making them a part of his organization instead of a free and independent organization, he would get a big element of goodwill.

We have had some very vicious legislation in California. They sit around a table and plan upon what they can do to aim at the public service corporation, as well as private individuals. And we

have found that the dealer cooperation is a big factor in offsetting that.

I am not here to make a dealer plea today—I am here to talk to you on a broader plane of advertising.

Now, first we will find out what advertising is. Lewey says that, "Advertising is leading people to believe what you want them to believe they want." I do not believe that is as good as this: "Advertising sells goods and goodwill, but its greater powers go beyond that—it builds a market standing and financial standing; it creates values that cannot be measured in dividends but represent solid assets in the larger transactions of re-financing, consolidation and ultimate consequences of successful growth. Advertising is not only a builder of golden credit but represents value insurance and trade insurance. It tends powerfully to standardize products, stabilize consumption and guarantee future markets."

We have three trade elements in advertising. The first is the element of wonder. As long as the element of wonder exists in a commodity, it is a valuable asset in advertising. The first railroad train could be used for advertising. But look what happens as soon as this element of wonder ceases to exist—they have to tell what the railroad will do and they also advertise where they can take you. They talk about the beautiful scenes they can take you to. (Referring to stereopticon view). Always selling what the railroad will do, rather than trying to sell the railroad itself.

The next is the element of sentiment. Here (indicating) is an ad that was taken out of the Saturday Evening Post recently. It is for Swift's Premium Ham. Any man in this organization who likes to fish, undoubtedly can appreciate that picture. That element is capitalized to a great degree in this series of ads. They are not running these ads for their health. They cost $7,500.00 a page, and they must pay or they would not run them. So this element is a strong factor.

Here is another one on the same thing. They are running a series. Here is another one—"How the Pilgrim Fathers got their Meat." Swift's are using this constantly to promote their business.

Here (indicating) is purely a sentimental appeal—"Cream of Wheat." It has been used in all the national magazines and has placed that commodity on the market in a way that possibly many of you know about.

Now, we will go back to 1895. Here is the most remarkable success in advertising the world has ever known—the automobile. This was the forerunner of the automobile—the bicycle. And in 1895 these men had the vision, the same as the automobile man has today. They told what the article would do—take you somewhere. In this case it shows what the bicycle will do, and this was the forerunner of the automobile.

Let us see how the automobile handles the same thing—sentiment—human interest. The Sunday before—everybody down in the mouth. The Sunday after—they have got an automobile. See the difference!

So they are selling what the article will do. No automobile salesman ever sold you an automobile—he sold you what the automobile will do—he sold you a ride.

In analyzing the last census we found that face powder and cosmetics were in

the billion dollar class—better than jewels. "Keep That Schoolgirl Complexion." (Indicating). No woman ever bought a box of face powder or a box of soap—she bought beauty. They put over their game here in a way purely on the appeal as to what the article will do.

Here are the B.V.D.'s. You can talk about underwear now in polite society since this form of advertising came into existence, and we know now what that produced. Even the men read the Women's Journal nowadays on account of the sentimental appeal.

Here is your Bull Durham Tobacco. Over a billion dollars a year for cigarettes. What did it? Purely this form of advertising.

I can remember when I was ashamed to admit that I had a phonograph in the house—kept it up in the garret. But they advertised what the article will do, and in 1915, when we were very much put to it for furniture in the United States, we found that our furniture factories had ceased manufacturing furniture and were manufacturing phonograph cases, and a hundred million dollars a year was going into phonograph cases that formerly had gone into furniture.

Here is a Hart, Schaffner & Marx ad. I can remember very readily when a few years ago we were ashamed to admit that we had a ready-made suit. We kind of sneaked in and bought one. Hart, Schaffner & Marx and Benjamin, and a few of these men, had the vision and started in to advertise. The result was that in 1917 when I made a talk before the Pacific Coast Gas Association, I found that there had been seventy million suits sold the previous year. Nobody is ashamed to buy a ready-made suit now. Why? Because they sold what it would do—make you look well.

A. B. Checks. When this check first came out through the Bankers Association, this (indicating) was the form of advertising they used. It did not go over. The people did not understand it. Then they adopted this plan (indicating), and today 75% of the people who travel get Bankers' Checks. They take you somewhere, they advertise what the article will do.

Kodaks. Most of you remember when the kodak was a new thing. Eastman has put over the Kodak on what the Kodak will do, not on the Kodak itself or the price, but simply on this form of advertising, because the first advertising was not very successful. They showed the camera, and it was not productive of results. But the moment they switched to this form, it went beyond computation.

Old Dutch Cleanser. There, I think, is the most consistent campaign I have ever analyzed. Always showing what the little Dutch Girls will do. Always showing what that article will do.

Now, does advertising pay? Is it profitable? Here (indicating) is an advertising company in New York, Philadelphia, Cleveland, Chicago, Boston, who are advertising themselves—taking their own medicine. I will just call attention to one of these articles, one of the ads they run, a little later, to show how it can be applied to our work.

Life Insurance. Every man wants to leave his family provided for. That is purely a sentimental appeal. You know what life insurance does.

Congoleum. There is something I know a little about. I did not suppose that it was possible to put over a felt

paste product, a floor covering, when the Congoleum people started in to advertise. Congoleum is a felt, a good deal like roofing felt, with a coating on it the same as they print on linoleum. They put it over by this appeal of how attractive it would make the home, and last year their appropriation was two million dollars. Two million dollars to advertise Congoleum!

Now, I am going to speak about the rival of the gas business. In the Ladies Home Journal, in a recent issue, there were seven of those pages, at $9,000.00 a page—and only one gas range. They are putting the human interest into every piece of advertising, and are making a strong appeal.

This is just preliminary to what I want to call your attention to.

This one (indicating) was on October 6th—double-truck, $15,000.00. There was not a gas stove or a gas ad in the paper.

Now, we come to electricity. Electricity uses all the elements that have the strongest appeal—wonder, romance and sentiment. Here (indicating) is your romance—when the Western Electric started fifty years ago.

"Choosing the Electric Servants for your Home." See how clever that is.

Here is another one—the Electric Sweeper.

I just want you to note, and to have it collectively before you, what an enormous amount of money is being expended by your rivals.

Here is another one—"The Belden Apartment Hotel, Chicago, chooses Westinghouse Electric Ranges."

I have an electric kitchen in California, because it is up in the mountains where we cannot get gas, and I have it fully equipped with every convenience I can get electrically. But I want to tell you it does not compare with gas, so far as efficiency is concerned.

"Cheaper Light. While the cost of almost everything has gone up, the cost of light has gone down." That is a price appeal, but it has the romance.

"Buy here." There is an appeal to the man.

You would not think that it would be necessary to advertise the telephone, would you? But they are doing it and making it profitable.

Here again — "Hotpoint Servants." They understand the psychology of advertising. They are using the appeal that will get over.

"Ever-Ready Flashlights." Look at the child there. The child is the strongest appeal there is in the home.

"This is the Life and the Light."

Now, this appeared on September 8th —"Hastening the Downfall of King Coal." Now, I look upon coal, under present conditions, as a competitor of gas. It should not be.

Here is a cartoon that appeared in the Literary Digest on the same date. He is driving away some of his best customers, and what is he driving them to? —Oil.

Here we have, in the same issue, a map of the proposed super power system of the U. S. Electric.

Here is a series of articles that have been running in the Saturday Evening Post—"Are We Burning Up Our Future?"—by Arthur D. Little.

Here is one by Floyd Parsons—"Food, Fuel and Smoke."

There (indicating) is what every man faces when he goes down to take care of his furnace. I have heard several discussions, since I have been at this convention, about the impracticability of your handling a furnace for the heating of a house. Gentlemen, you have got to come to it.

"My Dream of Comfort Came True." —Arcola. That is running constantly. Every paper you pick up has that character of advertising for that one appliance. But in every case you will find that they use coal. They tell how long the coal will burn, what a convenience it will be, but they do not say that you have to shovel the coal in through your basement window and take your ashes out through the basement door, and the trouble you have to go to.

Just see a few of these ads that are running in the papers today. I can not understand why it would not be feasible for the gas companies to carry on this form of advertising.

"Now comes a Heater that looks like a Phonograph and works like a Furnace."

There (indicating cartoon) is the man who has to go down and poke up the furnace fire. Some of them would rather stand over a coal-oil stove than do it.

I tell you, gentlemen, we have got to get to the men, we have got to reach the men in this great campaign.

Here (indicating) is a leaf out of a booklet put out by a gas company, advocating the use of gas for heating the home. I regret that I cannot say how many thousands of these furnaces have been installed in Portland in the last two years, but the number runs into the thousands. You can lie abed and read.

Gentlemen, this is an economic necessity. The country is going to call for it. Not long ago kerosene was a principal product and gasolene was the by-product—now gasolene is the principal thing. The by-products of coal—and you gentlemen in the gas business are the only ones that can save those by-products—are going to be compelled to heat the home, to do everything that is possible to turn coal into gas.

Here is a form of advertising being run today to offset that coal stuff. It is an advertisement of oil.

I want to tell you a little something about the "Better Homes." The bicycle came first, and then the automobile. The automobile takes us away from the home. We are living in an age of jazz right now. We have got to sell the American homes to the American people again. It was the home that made this nation great, the home that we used to have, where the kids could duck for apples in the kitchen and there was room for grandmother.

We noticed a few statistics in the last government report wherein automobiles were selling to the extent of three and a half billion dollars a year; amusements, three billion; cigarettes, one billion; face powder and cosmetics, nine hundred million; furniture, five hundred and seventy-three million.

Face powder had us off the map by about a quarter of a million dollars, and the furniture people thought it about time to wake up, so they started an agitation for a better home movement. It was so popular that it got out of the commercial hands within 60 days and

became spiritual. The President of the United States issued a proclamation on it. Hoover wrote articles. Coolidge wrote articles. Thirty-two governors of thirty-two states issued proclamations, and as a result, the national movement for better homes was started.

I want to tell you how far that reached. I rolled into Riverside, which is a little city below Los Angeles, about three o'clock one afternoon in October of last year. October of last year was the first time we had ever gotten the home before the National Association of Women's Clubs. This (indicating stereopticon view) is their convention at Cleveland. It was the first time that home was presented to a woman's organization. Well, as I said, I got into Riverside about three o'clock in the afternoon, and Mr. Mott there had made a window display, showing the living room of yesterday and the living room of today, and it was a very effective window display. He said, "Crane, you are just in time. The Baptist minister is going to preach." We had asked every minister in the United States to preach, and a vast number of them did. He said, "You want to stay over and go to the Baptist Church tomorrow night." I said, "I can't, I have to go to Los Angeles." But my wife was along—and I stayed.

So we went to this church—a very large church, with a big gallery. We got there at half-past seven, and that place was packed full. We finally found two seats in the gallery.

This fellow who preached was one of the Billy Sunday's without the slang. He got up, without any notes, and said, "I want everybody in this audience to stand up now and sing that Swedish song in the English language—'Home Sweet Home.'" They all got up and sang. They were full of the spirit. He put it into them.

He said, "You know, we Baptists are not very strong on theatricals, but I can't show you what made this nation great without showing you the old home, and we have reproduced it right here alongside the pulpit, and I want you to see what the home meant to this nation." And up went the screen and there was the old living room. There was Ma and Pa, reading, with a marble top table over here, and a couple of kids playing a game, and two or three young people over here, busy. And they had a "what not." I had not seen a "what not" in years. They had a haircloth sofa—and the old melodeon. How many of you have seen a melodeon? I had not seen one in thirty years. And one of the girls was sitting at the melodeon, and as soon as the curtain went up she began to play the melodeon, and they gathered around and sang. Then Pa read a chapter out of the Bible. Then they gathered around and sang four or five hymns, and then the curtain went down, and that fellow then preached a sermon.

Say, he sold the home to everybody in that audience, believe me. I could see them wiping their eyes.

That is what the better home movement means, and the gas people have not tied in with it. The electric people have. I have only found three or four places where the gas people have taken advantage of this movement.

We may say that we ought not to commercialize a spiritual movement like that. But what would this country be worth if it was not for the commercial interests? We have got to bring the commercial thought into it, and it is

perfectly legitimate, and we should tie in with this.

I am telling you this, just because it is leading to what I want to say, finally.

Here is the greatest factor in the world. There is no factor in the world that compares with the American kitchen, and it is the poorest equipped. There is where we dump more money into than any other place. Let us see what the other fellow has.

By the way, there (indicating cartoon) is something that came out two months ago in "Good Housekeeping."

Let us see what the mechanic has. All of our thought is for the mechanic. Here is "Keencutter Tools." Look at the boxes and boxes of those tools. Disston saws. More tools. 1500 good tools for the mechanic. Louden Carrying System. Everything to help the man. And when he comes home that is what he finds (indicating).

I tell you, gentlemen, we have got to appeal to the man's pocketbook.

This fellow (indicating) wants service, and how does he expect to get it?

Now, here (indicating) is the old time office. It is not so many years ago but that many of you will remember that form of office. What happened? An inventive genius got busy. Addressographs. The typewriter. You know, if the typewriter had been invented for the kitchen, there would not be a thousand of them in use today. Here is your multigraph. Adding machine.

Take these things away from this fellow, and that is what he would be like —tied to his desk. (Indicating cartoon.) He could not turn out one-tenth of his business. And yet he expects his wife to do it.

So we have got to create a rebellion in the kitchen. Let him bring home the flowers and get that kind of a reception (indicating cartoon) and there would be proper equipment installed in that kitchen.

Who is doing the bulk of selling the kitchen today? There (indicating) is the kitchen cabinet. I do not think that is a very good appeal—to tell the average man to save his wife's steps. He would probably say, "She has plenty of time." So we have got to appeal to his pocketbook, and paying fifty cents an hour minimum, as they are paying today, for outside steps, there is your appeal to the man to put in an up-to-date, properly equipped kitchen.

Here is another one—a Napanee. Shows how many steps it saves. They are doing the bulk of the work today in selling the kitchen for the gas range, because they show effectively equipped, properly arranged kitchens.

Let us talk about the advertising again. "The Poplar and the Elm": "If you want a tree for today," goes the old saying, "plant the poplar. But if you want it to be there tomorrow, plant the elm." The poplar and the elm are both ambitious, but the poplar lives for the present alone while the elm has thought for the future. In the eagerness of its ambition, the poplar sends forth branches in the spring without developing the strength to support them in the sluggish days of summer. Its roots are constricted, its spread is narrow, its life brief. The elm grows roots that are deep and spreading. Expansion is its nature. Its fibres are tough and strong; it weathers wind and storm; it lives and grows for generations. "Business has its poplars and its elms."

Now, I am going to give you a rough idea of a plan, in the hope that it will start you thinking along lines that will bring about a form of advertising that will give the gas industry its proper representation before the public.

Let us take the gas companies first. A fraction of a cent, or two mills per thousand feet of gas, would give us approximately $640,000.00 a year for advertising.

Now, if Congoleum can use $2,000,000.00, it would seem to me feasible for gas to use $640,000.00.

The first recommendation that we make is to start a prize compaign. Now, the prize campaign is an old idea. It has been tested over and over, but never has failed. There are prize campaigns running today for one thousand, two thousand, five thousand dollars, but there has been none that had the nerve to go to it on the basis that would make the whole United States sit up and take notice—and fifty thousand dollars is a very small amount of money to put into a campaign of this kind, if you can get a reader interested.

So I am advocating here twenty-five thousand dollars to be divided into one thousand prizes, ranging from two thousand dollars to five dollars for the best letter or letters written by the school children of the United States on "Gas as a Servant."

Why do we ask the school children? Because, first, the school children of today are the mothers and fathers of tomorrow. Second, the school children will pester mother and father and the school teacher and everybody else to help them write that letter.

This is not a scheme that I have not tried. I tried this out when I was compelled to put a large store on the map in San Francisco several years ago. They were in an off position on the street, eleven blocks from the beaten track in an unknown district and with an unknown name. The first thought that we had was to bring before them our name and where we were located. So I started a campaign for jingles, with the name of the firm and the location, hoping to get enough to cause some interest.

We had 30,000 answers, and there was one from China, two from Belgium, three from England and two from Australia. They were advertised in the local papers. I had to take that stuff home in a bushel basket to sort it out. And we were on the map inside of 60 days, because the kids pestered every school teacher and everybody. The mayor of the city brought in two jingles his kid had written. That is the appeal to the child on a contest. We are all gamblers at heart.

I am only offering this as a plan that the Pacific Coast is interested in.

There will be ten thousand dollars, divided into five hundred prizes, ranging from two thousand to five dollars, open to all, for the best letter on "Gas as a Household Economy." Ten thousand dollars, divided into prizes ranging from one thousand to five dollars for the best slogan, typifying gas as a household servant. Five thousand dollars in prizes for the architects or domestic economists for the best plan for an efficient kitchen, featuring gas ranges.

Those prizes, first, will give us a reader interest. That is what we have got to have in the advertising business if we are going to put over real, downright constructive stuff. We have got to have a reader interest first—and we have not the reader interest in gas today.

You can put out this character of advertising after a campaign like that, because everybody is interested and they are going to watch for what comes out on gas, providing you have created this interest. So that you can get your constructive matter before them, following a contest, whereas it would not be read prior to a contest.

Here (indicating) you see what the National Bank of Commerce of New York are running. The electric light people are doing the same thing.

I am bringing in something that there is a dire lack of in the gas industry, and that is a manual for salesmen. There is romance about gas, but it has never been brought out.

The romance in gas today is negative. When you speak of gas today, on account of the laxity in advertising, people think of the boys in the trenches. That is negative advertising. And you read an article in the paper about a man who was suffocated. I heard a woman two weeks ago say that she would not have a gas range in her house because it would blow up.

We have got to bring out the positive side in gas—the romance of it. The air we breathe is gas. The water we drink is gas. We have got to have water to live, but we cannot live in it. We have got a great element of romance to develop. We have got to bring out, in a very plain, straightforward way, through the source of a manual, all about gas and what it is good for and how it can be applied, so that that can go to every salesman and go to the domestic science schools.

We have started this series. There is one being prepared now on gas. First we took something in furniture. We took beds and mattresses, and I found, very much to my surprise, that the high schools are using these manuals as text books. So if you can get your propaganda into the high schools for the children to read and study and take examinations on, you are going to accomplish a great work.

Now, it is up to the gas companies to get out this constructive literature and run their ads in the national magazines like the Ladies Home Journal, the Saturday Evening Post, Good Housekeeping, and all of those national magazines that are moulding public opinion. You have got to have it. Every other industry is doing it. Leave the billboards, the calendars and cards, etc., to the factories. Let them get out dealers' helps that will be effective.

Then when you come to your newspapers, see that the dealers throughout your territory run strong newspaper campaigns.

I want to show you just what happened in the last Gas Week, which was April 16th to 21st. In every section of the Pacific coast there were sections in the Sunday papers for that week, the same as you see here in this "Portland Oregonian." (Indicating.) Identically the same as the automobile section. Some had eight pages, some had twelve, some had only four pages, but they were pages of reading matter about gas. I have just this one of Portland, but there were Santiago, Portland, Los Angeles, Sacramento, and all the big towns on the coast that ran these special sections.

This (indicating) is a little of the advertising that appeared that same week —31,147 inches of paid advertising that week.

Now, the Pacific Coast Gas Appliance Society raised a fund of $3,800, and the

dealers paid $35,000 as their part of it, and they sold $500,000 worth of gas ranges in a very limited territory. When I left, we had not checked up on the south, but there were 180 dealers in the north who sold half a million dollars worth of appliances in a week. So you can see that form of advertising is very productive of results.

I am going to touch on your windows again. Many of you remember when this was the form of advertising a cigar store used. (Indicating picture of wooden Indian outside of cigar store.) But the United Cigar Stores got the vision. This is the form of window they use, and you know what the results have been.

Here (indicating) is the prize winner. There were prizes given and this won the first prize—Santa Maria had the second prize and Los Angeles the third prize.

Now, I am going to recommend for the next Gas Stove Week that we have comparative windows. Comparison is a great basis for creating public interest. Let us go back to one window and show the cooking appliances of yesterday. Here (indicating) it was in Tut-ankhamen's time. Here (indicating) is George Washington's kitchen. This (indicating) illustrates the courtship of Miles Standish. In Miles Standish's time the kitchen was the living room. Here (indicating) is the kitchen about which the song, "Home Sweet Home" was written.

I was just talking to the gentleman who prepared those windows yesterday, and asked him whether or not it would be feasible for him to prepare a series of windows to go along with these windows and send it out in printed form so that the dealers all over the United States could show comparative windows at the next gas range drive.

There (indicating) is the kitchen in the house about which "Little Women" was written—Louise Alcott's story.

I am sorry I could not have had more good windows to show you along with each one of the old windows.

They say the way to reach a man's heart is through his somach, and I think if we put in the proper form of window we can awaken men to the need of proper advertising.

The first reaction that I get from any man to whom I submit a plan, is, "Who has done it?" We are going to touch on who has done it. First, I want to show you what a national magazine circulation means. One issue of the Ladies Home Journal, if it was stacked one on top of the other, would be 40,665 feet high. Pike's Peak is 14,108 feet high. There are probably more women readers of the Ladies Home Journal in each of your towns than there are for your local paper. So these national magazines are getting the readers, they are reaching the people, and they should be taken advantage of by our industry.

We will touch on who is doing this form of advertising, because it is always convincing to know that somebody else is doing it and making a success of it.

Here (indicating) is the National Board of Fire Underwriters. Here is the Diamond Brand Walnuts of California. Southern Pine Association. Copper & Brass Research Association.

"Say It With Flowers." And, by Jove, there is something that should touch you. You know what the florist was a few years ago—a little hole in the wall. But he got the vision and started a campaign of advertising. He picked a

slogan. That is why I put in that slogan contest, because we know that that is effective. The old slogan we had, "Cook With Gas And Keep Cool," did more harm than good, because no one wants a gas stove in winter now. We want to do away with that idea that she is going to cook with gas and keep cool. We want to get a slogan that will produce the results we want, and we want a slogan along the lines of the slogan, "Say It With Flowers." When they started this campaign they were a little hole in the wall, and inside of six months you could buy flowers in San Francisco and have them delivered the next day in Boston. That is organization. That is collective advertising. And you know what the florist amounts to today.

Here we have, "Save the Surface and you Save All." When they started they expected in 1925 to reach their quota in advertising and they have reached it in 1923. Here they are using the prize contest plan. A thousand dollars in prizes for the best title to this picture. Here (indicating) are the winners. They are scattered all over the United States, showing how broad the interest is.

I saw in last evening's paper—a Philadelphia paper—that a contest was run and there were 440,000 answers, and all the girl got who won it was a gold watch and a trip to Washington.

Here is a thousand dollars in prizes for the best stories and pictures of notable American landmarks. They have got the vision.

Here is your canned goods association—National Canners Association. "Lighting Helps in Selling." Here is the Portland Cement Association. National Mazda Lamps. Copper & Brass Research Association, showing every point of the house. Southern Pine Association again. Sunsweet.

Here are the California Raisin Days. This has been the most remarkable campaign that I know of, because when this campaign was started, raisins were a drug on the market; the grower did not get a cent a pound—he had a red ink balance from the railroad on his freight. Today they are taking care of ten times the acreage they took care of prior to this advertising campaign, and they are keeping pace with it.

Here are the Sunkist Oranges. Formerly, after the crops were shipped they showed red ink. Today, they are profitable.

There is your walnut. Walnut pretty nearly put mahogany out of business. The mahogany people had to organize and come into the national magazines to hold their prestige.

Here is the Jewelers' Association. The Wall Paper Association—all using national means for advertising.

The Davenport Bed. Here is something that I want to call to the attention of the appliance man. Five years ago the Davenport had reached what the factories thought was the saturation point—it was dropping. They organized an association of this character, and put 25 cents per Davenport into a common fund. Today their sales are four times what they were at the peak. That shows whether or not advertising is effective.

Here is your National Electric Light Association. They are using nationwide copy and using it very effectively. They are doing it through an association and getting an appeal, because the people are interested in electricity on account of the enormous amount of propaganda

appearing in the newspapers almost constantly.

Here is your common brick industry. And here is sauerkraut. Now, if sauerkraut can afford to advertise, can gas?

I just want, in closing, to call attention to an electric advertisement that has all of the appeals that we know of in the advertising business—wonder—romance—sentiment. This is the only ad that I ever saw that really, to my mind, justified the use of Abraham Lincoln. Always I have looked upon the advertisements depicting Lincoln as being sacrilegious. But this, I think, is a just appeal: "Nancy Hanks, the Mother of Abraham Lincoln, died forty-three years before her son became President. She washed clothes, scrubbed floors; she got up in the dark; went to bed by a flickering flame; she died at thirty-five. Somewhere today a mother is rearing a future president. The hard labor in her home is done by small electric motors. She will be present at her son's inauguration, looking and feeling young."

Now, gentlemen, the president of the Pacific Coast Gas Association asked me to deliver this message. I am not an orator. If I do not get it over it is not his fault. But he left this word—he said, "Take it to them, to father a movement for broader advertising, and let us tie in. But if they do not do it, we are going to do it, anyway."

I want to again thank you for the privilege of having the opportunity of presenting our plea before this convention.

The Chairman: I cannot help but feel that you all have been somewhat amazed, somewhat startled, at the comparison Mr. Crane has made, as to how much advertising, in a constructive way, other industries are doing, how they are getting together and bringing before the United States what their products will do.

I have heard so many times manufacturers' representatives talk to our salesmen about what the appliance was made of, what class of metal and material went into it, and the processes through which it went, and appeal to us to come to their factory and see how it was made. Very good, as far as it went, but it did not go far enough.

Any appliance that is sold today is not sold for the appliance itself. An appliance really does a service, and that is what the money is spent for. We sell a water heater to get hot water and the conveniences that hot water gives. We sell a range to cook with. We sell a room heater to heat with, and it is of no material interest to the housewife or the man of the house how that appliance is made—it is what that appliance will give toward bettering the living conditions in that home that is important.

I feel that this is a wonderfully important message that we have listened to, and on the part of this Commercial Section I wish to thank Mr. Crane and the Pacific Coast Gas Association for sending him to us. And I do hope that this message will not stop here, but that it will be taken up by the incoming chairman, Mr. Davies, and his vice-chairman, Mr. Hanlan.

Mr. Crane, allow me to thank you on behalf of this section and on behalf of the American Gas Association for the privilege we have enjoyed in having you here. I trust that in time to come you will be able to point out to the Pacific Coast Gas Association definite results of your visit to us at this time.

The next paper on our program is a paper entitled "Supporting Your Sales Organizations with Proper Water Heater Installations."

Before introducing the gentleman who is to speak, I would like to make a little explanation as to why this paper is being given. With all the other support that the sales organization should have, if the most efficient water heater or any other appliance is not properly installed, what good is it? Instead of being any good it is a distinctly detrimental influence.

SUPPORTING YOUR SALES ORGANIZATION WITH PROPER WATER HEATER INSTALLATIONS

G. C. Carnahan, Manager, Heating Division, The Peoples Gas Light & Coke Co., Chicago, Ill.

It is generally conceded by Gas Companies that Gas Fired Water Heaters for domestic use increase the sales of gas to a very large degree. It seems logical, therefore, that every consideration should be given to ways and means that will bring about increased water heater sales.

A great deal has been said and written concerning the getting of orders. Sales Departments of most gas companies have reached a fairly high state of efficiency in selling the heaters that are best adapted to existing conditions and in furnishing the service required; but this is only one step in the making of a really satisfactory sale. Unless the heater remains sold, the primary effort is wasted. Since the main object of the Gas Company is to sell gas, the heater must remain satisfactory, and this can only be possible when the Installation and Maintenance Departments are brought up to the same high standard of efficiency that now exists in the Sales Department.

The importance of proper installations, adjustments, and maintenance cannot be emphasized too strongly nor too often. This branch of the business is often in charge of men who have no means of knowing that certain practices will lead to unsatisfactory operation, or high gas bills, because after the heater is installed, they never see or hear of it again. It is only when all branches of the business are under one central organization that the benefit of experience with heaters in operation can be put to use by all for the betterment of service to our customers. The sales manager should be personally conversant with the deficiencies of the heaters in use, and this knowledge can only be obtained through contact with the Maintenance Department. He must also be in active touch with the Installation Department, as at least 75 per cent of the causes of unsatisfactory service and high operation cost are due to improper installations and adjustments rather than to any defect in the appliance itself.

Common Errors of Installation

It is the purpose of this paper to outline some of the most common errors that are constantly made, with a view to influencing the better education of men in the Installation and Maintenance Departments to do their work more efficiently, so that water heaters we sell will

be sure to have a fair chance to give the customer satisfactory service. Satisfied customers augment pleasant business relations and influence the general the object is to obtain adequate hot water service. The utmost care should be exercised, regardless of the size or type of appliances sold.

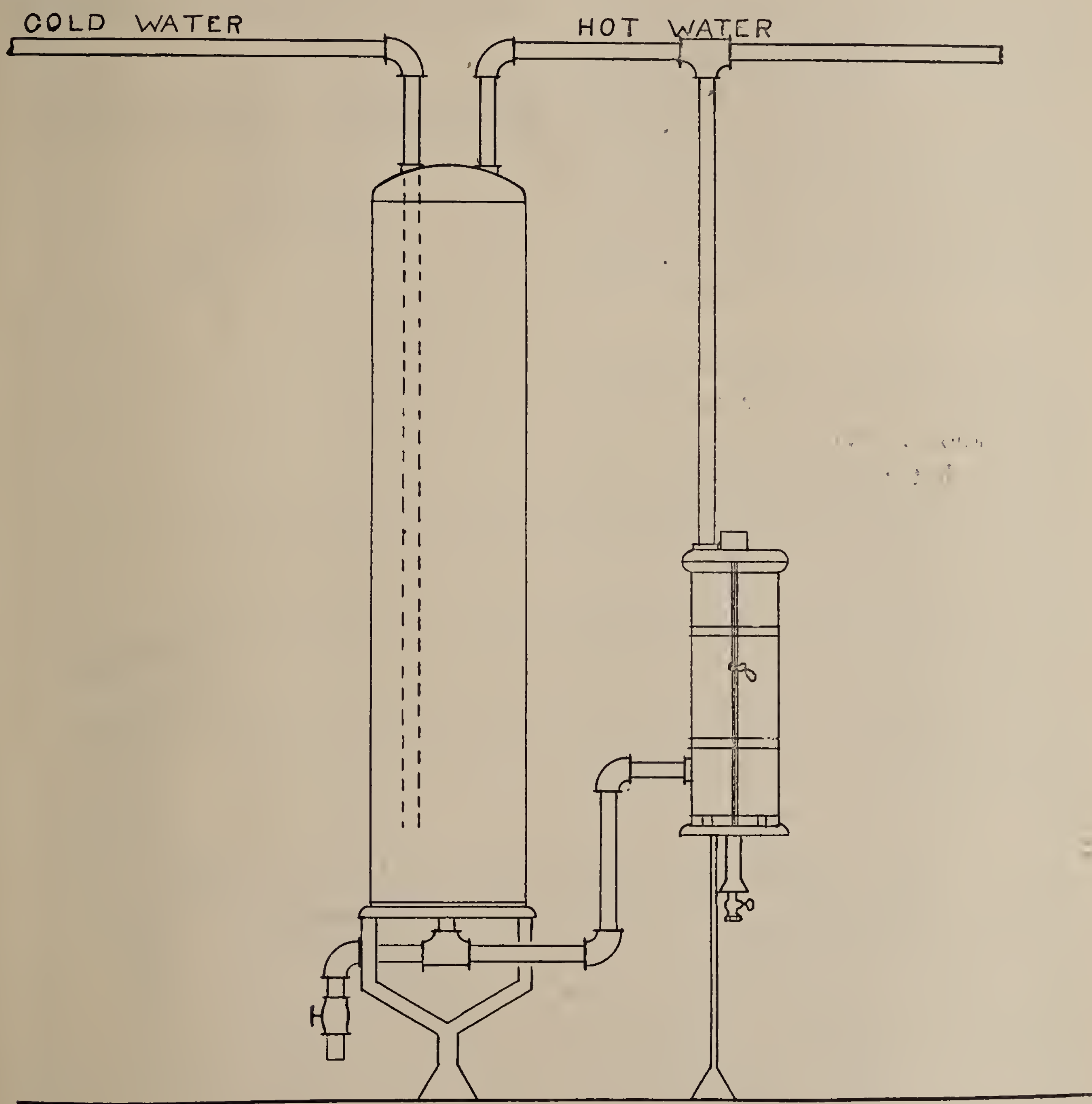

Fig. 1

public favorably with regard to the use of gas for water heating.

The importance of proper installations and adjustments is the same to the customer whether he purchases a tank heater or the most expensive instantaneous or storage system, for in either case,

The tank heater is the one that we sell in greatest numbers; therefore, we will give it first consideration. Connecting the tank heater may seem a simple task, but there are thousands of these heaters in use which are not giving the service they should, or could, if installations were properly made. For

many years, it was only considered necessary, in making the water connections, to connect from the bottom of the tank to the lower connection on the heater, and from the top of the heater to the hot water outlet leading to the fixtures. Many connections which were made in this manner, as illustrated in Figure 1, were not satisfactory. The customer did not always get water as hot as he would like to have it, and undoubtedly decided that he could not expect any better results from a gas heater.

This is what really occurs when connections are made in the manner described above. When water is drawn from the hot water line, part of the water enters the line from the top of the tank and some of it comes from the bottom, around through the heater connection. If the heater is not burning at the time, this water would be cold and the result would be that the water running from the faucet is always lower in temperature than that in the top of the tank. This is most marked when the heater is not operating and always exists in varying degrees when the hot water circulating line connects direct to the hot water line leading from the tank. Another important feature that developed in a connection, as shown in Figure 1, was that the cold water circulating line filled with sediment in localities where the water supply was from lakes or rivers. This condition soon manifested itself in the form of very hot water or even steam at the top of the tank and a hammering in the coil. With the introduction of tank couplings, a connection that eliminated both by-passing and sediment in the cold water circulation was possible. (See Figure 2.)

In this type of installation, there is no direct connection between the circulation lines of the heater and the hot water outlet from the tank. Therefore, by-passing through the heater is impossible and if the tank is flushed out

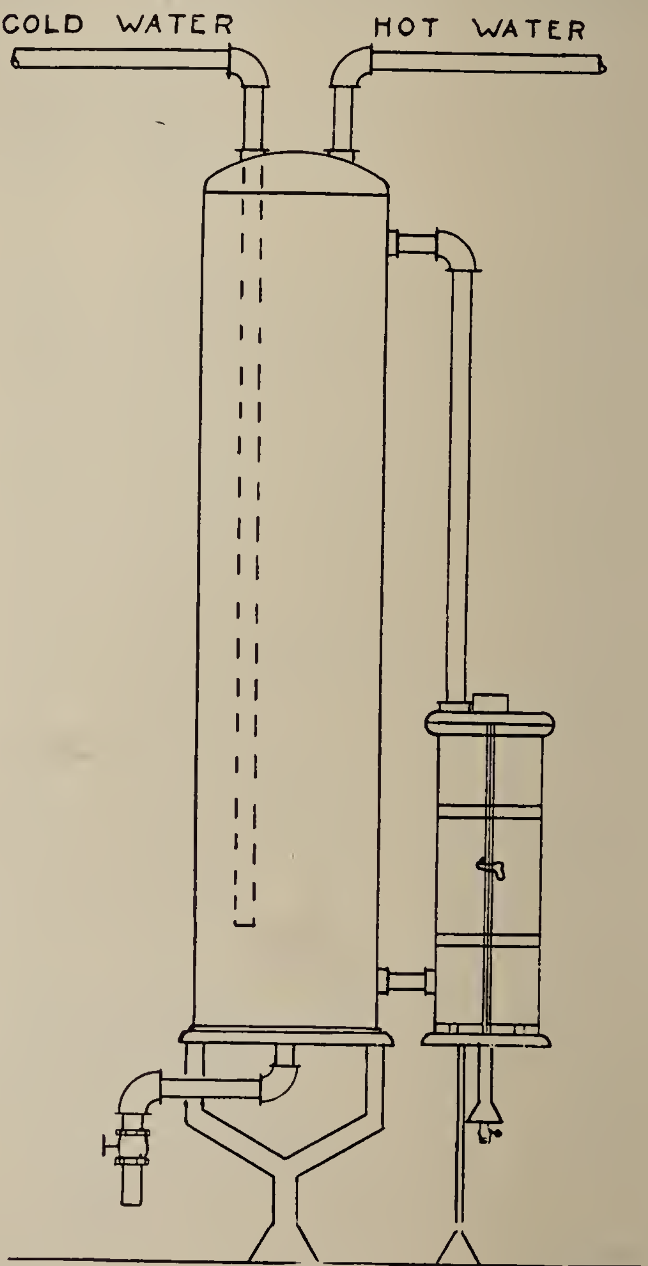

Fig. 2.

frequently, the heater will be kept reasonably free from mud and gravel.

Furnace coil, water back, or coal heater connections to a tank, on which a gas heater is used, are sure to give trouble when the hot water circulator is connected direct to the hot water outlet of the tank. When these auxiliary

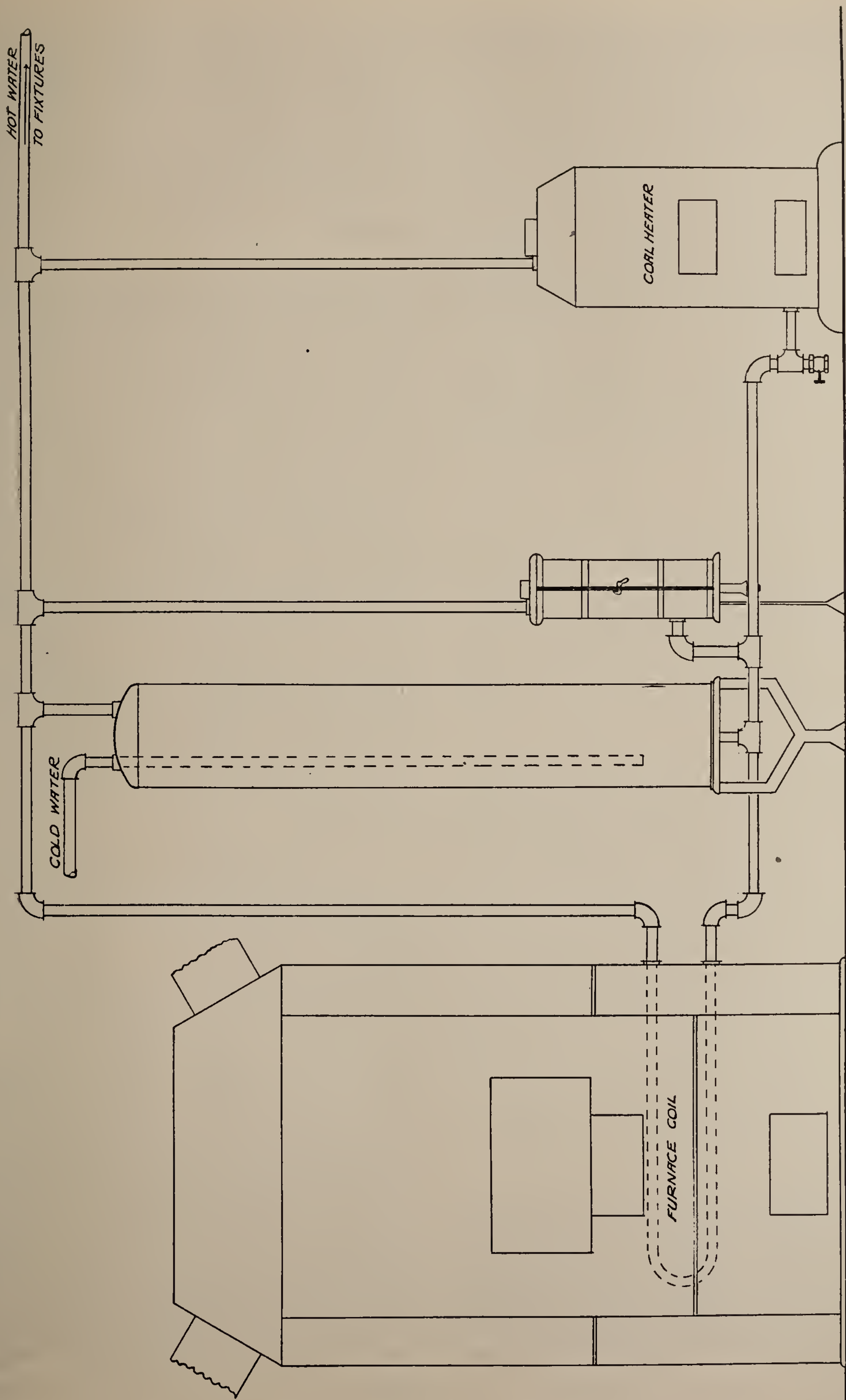

Fig. 3

attachments are not in use, they allow cold water to flow into the hot water line.

Figure 3 shows a type of installation we sometimes find where the customer complains that he can never get hot water, no matter how long he burns the gas. Either the coal heater connection, or the furnace coils would prevent his getting hot water if they were not being heated.

Back circulation is also sure to result if all the appliances are not fired when connections are made as shown in Figure 3.

The position of the heater on the tank is also important. It should not be too high, and all the connections should be full size of opening on heater with a minimum number of fittings. Piping should be reamed to permit freedom of circulation.

One other common connection, where cold water is by-passed into the hot water line, is through a return circulation line. Many circulation systems are not equipped with check valves and when water is drawn from a hot water faucet, it is supplied through the hot water line with hot water from the tank and with cold water through the return. The result is a supply of warm water from the hot water faucets. A swing check, allows the water to circulate but prevents a backward flow through the return.

Tank heaters, as well as all other gas water heaters, should have a flue with a draft hood connected to the chimney. Draft hoods were designed originally to protect pilot lights in the automatic heaters, but their value as a draft regulator is now well recognized. Too much draft is as undesirable as too little, and this is especially true of the tank heater. Excessive draft lowers the efficiency and often causes flashing by pulling excess primary air through the mixer and may also induce back circulation by the lowering of the temperature in the coils when the heater is not lighted.

Figure 4 shows the effects of varying draft conditions on a tank heater connected to a chimney with and without draft hood in the flue pipe. It will be noted that when a draft hood is used, approximately the same efficiency prevails under all possible conditions from a down draft to an excessive up-draft; while, *without* a draft hood, it is only under ideal conditions that the maximum efficiency is obtained. Where there is no draft at all, or a slight down draft, a very dangerous condition develops in a heater not equipped with a draft hood. Large amounts of carbon monoxide are produced and thrown into the room and the efficiency of the heater is reduced.

It is generally considered that a chimney which extends above the roof, showing a draft when tested with a piece of burning paper, will serve all the requirements of any type of gas water heater. This supposition is far from correct. The chimney may not extend far enough above the highest point of the roof or adjoining building to prevent down draft when the wind is from certain directions. If the chimney has no other heating appliance connected to it, except a gas water heater, which has intermittent operation, there may not be any movement of air in the chimney at certain times, and the temperature of the flue gases from a highly efficient water heater may be insufficient to create necessary draft before carbon

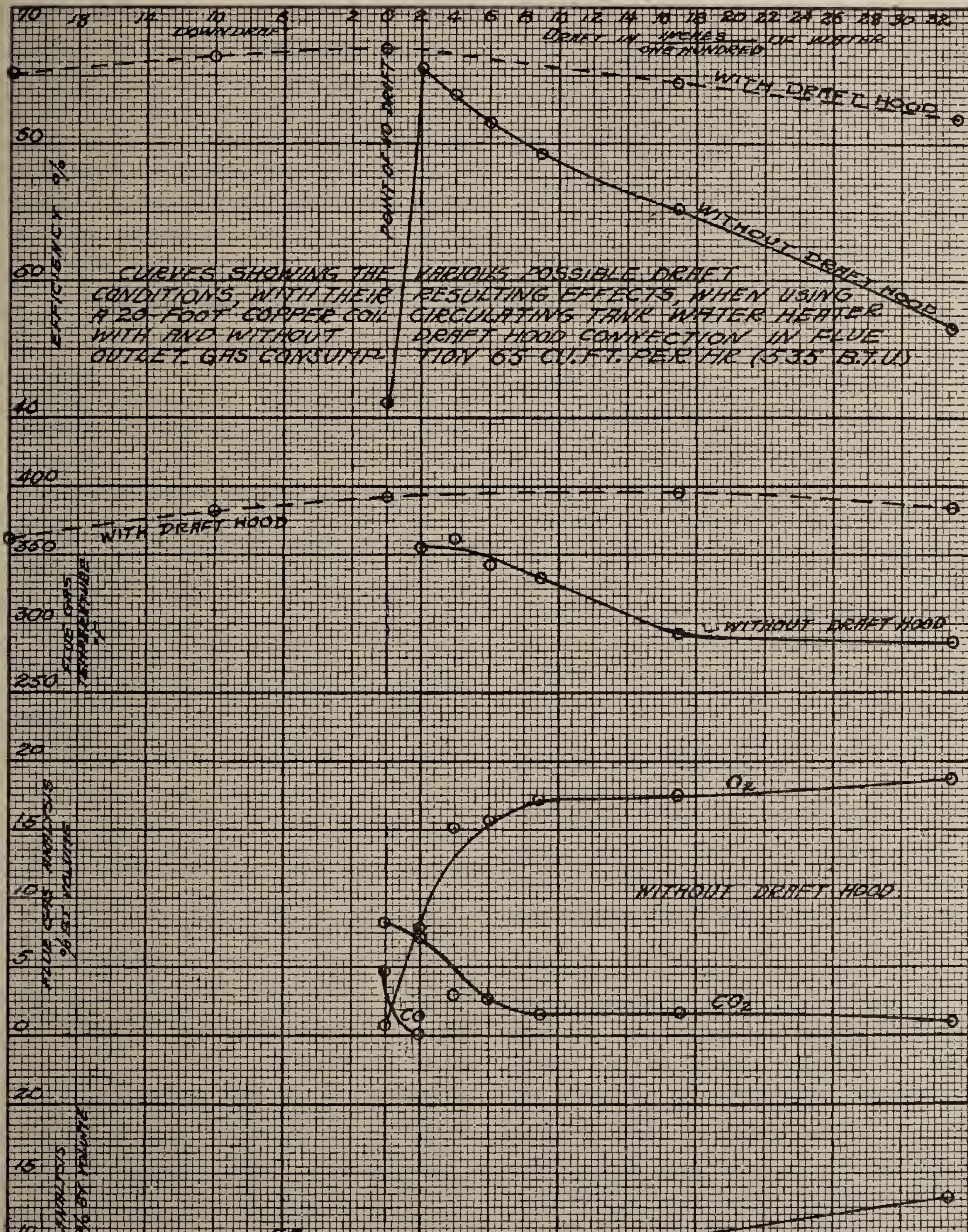
DOWN DRAFT
DRAFT IN INCHES / ONE HUNDRED OF WATER
POINT OF NO DRAFT
WITH DRAFT HOOD
WITHOUT DRAFT HOOD
EFFICIENCY %
CURVES SHOWING THE VARIOUS POSSIBLE DRAFT CONDITIONS, WITH THEIR RESULTING EFFECTS, WHEN USING A 20 FOOT COPPER COIL CIRCULATING TANK WATER HEATER WITH AND WITHOUT DRAFT HOOD CONNECTION IN FLUE OUTLET. GAS CONSUMPTION 65 CU.FT. PER HR (535 B.T.U.)
FLUE GAS TEMPERATURE °F
WITH DRAFT HOOD
WITHOUT DRAFT HOOD
FLUE GAS ANALYSIS % BY VOLUME
O_2
WITHOUT DRAFT HOOD.
CO_2
CO
FLUE GAS ANALYSIS % BY VOLUME
CO_2
WITH DRAFT HOOD
O_2
NO CO. PRESENT

Fig. 4

monoxide is produced in the heater and escapes in the room.

If the chimney has been previously used with a bituminous coal burning appliance, large quantities of soot and ashes will adhere to the walls, and the moisture, resulting from the condensation of the flue gases, will saturate this material, which adds to its weight and causes it to fall, and in many cases, block the chimney entirely.

In a well-constructed building, where all the doors and windows are closed tight, as is the case in the winter time, if two chimneys extend from the same room, the chimney that is continuously heated, as with a furnace, may cause a down draft in the chimney that is intermittently heated by a gas water heater, resulting in all the evils of a down draft; such as the production of carbon monoxide, gas burning outside the heater, etc.

It is proved, by the experimental data shown in Figure 4, that the use of a proper draft hood maintains the most suitable draft condition, and prevents undesirable and dangerous effects that may result in varying draft conditions.

Installation of Automatic Water Heaters

The application of the proper thought and care to the installation of an automatic or storage system should begin the moment the heater is uncrated on the customer's premises. The placing of the heater in a position best suited to the location of a good chimney and to the location of the fixtures to be supplied, is the first important step. The heater must be connected to a chimney that will provide proper draft without interfering with the other appliances and must be sufficiently close to avoid destruction of the flue pipe by condensation.

In older houses, extra chimneys are available and it is regrettable that this condition does not prevail more often in newer homes, as it must be admitted that connecting a flue larger than 4 in. into a chimney with a furnace or boiler flue, especially if it is of the down-draft type, affects the draft. Draft being created by temperature, the introduction of cold air through the water heater flue produces the same effect as a check damper and the connecting of the heater flue above the furnace flue seems to be more detrimental than connecting below. Water heater flue pipes should never be connected with small metal vent pipes or ventilating system, and should never be run outside of the building, even though extended above the roof, unless they are insulated or built of material that has an insulating wall, for otherwise it is impossible in cold weather to maintain the necessary difference in temperature in the flue used with a water heater of high efficiency and intermittent operation.

Hot water must be delivered to the faucets with the least delay and at the lowest cost. Long and oversized hot water lines have an important bearing on this matter. The following table shows the number of feet of various sizes of piping that will contain one gallon of water:

100.8	ft. of	3/8″	pipe contains a gallon
63.2	ft. of	1/2″	pipe contains a gallon
36.1	ft. of	3/4″	pipe contains a gallon
22.3	ft. of	1 ″	pipe contains a gallon
12.8	ft. of	1 1/4″	pipe contains a gallon
9.4	ft. of	1 1/2″	pipe contains a gallon

On ordinary residence installations where most of the faucet tailpieces are 3/8″ and 1/4″, it is seldom necessary to use a larger hot water delivery line than 3/4″. If an ordinary range boiler is in use, it must be remembered that the smaller sizes have 1/2″ cold water

dip pipe and the larger ¾", which affects the amount of water flow regardless of the size of the lines to the fixtures. A ¾" pipe of equivalent length of 100 ft. figuring a T equal in resistance to 4 ft. of length and each ell at 2 ft. of length, will pass six gallons of water per minute with a loss of about 4½ lbs. pressure. A ½" pipe 50 feet in length, figuring in the average number of ells and Ts, will pass up to four gallons per minute without an excessive drop in pressure. In some cases, even ⅜" pipe will pass sufficient water to provide an adequate supply at lavatory faucets.

It is plain to be seen where water is not circulated, that the smaller the hot water delivery line, the shorter will be the wait for the hot water, and a correspondingly smaller amount will be left in the delivery line to be lost by cooling. Hot water lines should be as small as possible and yet provide an adequate flow at all fixtures. These sizes will vary in different cities, depending on existing water pressure and the possibility of the presence of rust and sediment.

Advantages of Small Hot Water Piping

Changing a 1" delivery line 50 ft. in length to ¾" has the same effect as moving the heater 19 ft. nearer the hot water fixtures and reduces the amount of water contained in the line about .86 of a gallon, while changing 50 feet of ¾" pipe to ½" has the same effect as moving the heater 21.5 feet nearer to the fixtures and reduces the water in the line .59 of a gallon. Locating the water heater as near to the fixtures as all conditions will permit is always imperative, but many water lines are much too large for economical and satisfactory service. To accomplish the desired result, return lines, which are already installed, may be used to advantage. They are often one size smaller than the hot water delivery line and by converting the basement portion of the return to a hot water delivery line, a more satisfactory installation can be made at very little expense. In any event, oversize water lines should be changed, for the expense incurred will be saved many times by the reduction in the gas bill.

It will be noted that this paper deals principally with the installation of water heaters for domestic use, and on such jobs we encounter both the circulating and direct hot water delivery systems. As is well known, the purpose of a circulating system is to maintain hot water at the faucet, eliminating the necessity of emptying the pipe between heater and faucet. This is quite essential in large buildings where the runs of pipe are long or in cases where cistern water is used and it is desirable to conserve the supply.

Water can be circulated with an automatic storage system the same as with any other tank system, and can also be circulated with the automatic instantaneous heater by the use of a booster attachment, but in the average size residences, the direct system is preferable because of the greater economy of operation. Its only disadvantage is the short wait, and as most of the hot water is used at certain periods of the day, for an hour or so, each individual does not have to empty the line.

From the following figures, it is evident that where hot water is stored in a tank or circulated to provide the proper service, the loss in radiation should be reduced to the minimum by insulating all exposed piping on old jobs, and the entire hot water and return line on new

TABLE SHOWING THE HEAT LOSS FROM UNCOVERED PIPE AND TANKS MAINTAINED AT A TEMPERATURE OF 140° F.

Heat Loss from 100 ft. of Pipe		Cubic feet of 535 B.t.u. Gas used at 74.7% efficiency to replace the heat loss.
	B.t.u. per 30 days	Cu. ft. of gas
½" pipe	2,296,000	5,700
¾" pipe	2,851,000	7,000
1 " pipe	3,585,000	8,900
1¼" pipe	4,514,000	11,300
1½" pipe	5,191,000	12,900
2 " pipe	6,497,000	16,200
30 gal. tank	1,738,000	4,300
66 gal. tank	2,822,000	7,100
120 gal. tank	3,936,000	9,800
250 gal. tank	6,032,000	15,000
500 gal. tank	7,872,000	19,600

85% to 90% of this loss will be eliminated by the application of proper insulation.

work, as well as the tank. When an automatic heater of either type is installed and the circulating line is to be discontinued, the mere valving or cutting off near the tank is not sufficient, if there is a separate water flow and return line to each fixture.

Figure 5 represents an installation in which an instantaneous heater was installed in connection with a tempering tank, equipped with a return circulator which was cut off at the tank. When hot water is drawn at any faucet; say for example, (a) water will leave the heater and travel direct through hot line towards this faucet, but some will go up line toward faucet B, back down the return line and backward through the main return to A. Hot water will also pass up the hot water line to C and back down this branch of the return to the main return line and travel toward faucet A. With the indicated method of cutting off the return, hot water cannot be drawn at any of the faucets, at the temperature it leaves the heater, without flushing all branches of the hot and return lines. This has two distinct disadvantages. It delays the service by increasing the length of time for hot water to arrive at the fixtures and also increases the expense of operation, due to the increased amount of hot water that remains in the piping to cool off after each time hot water is used. To prevent this waste and delay, each branch of the return line must be valved or cut off. This applies to both instantaneous automatic and automatic storage heater connections.

Another faulty installation that results in all the evils heretofore described, is illustrated in Figure 6. You will note that the automatic storage system has been installed without disturbing the return line, where it is connected to the old tank. This will also result in keeping both tanks hot. If it is necessary to circulate water, the return should be connected to the new system, and a check valve used and if it is to be discontinued, the practice recommended in connection with Figure 5 should be employed.

Overhead Circulating System

Another common method of installing a return circulating system is to run the hot water line from the tank up through the building, supplying the various fixtures, and make the kitchen sink the last fixture on the return to the tank; the theory being that the kitchen sink having frequent use will keep the line alive and stimulate circulation. In this case, if the return is cut off at the tank, it will be necessary to empty the entire hot water piping to get hot water at the kitchen. To avoid this, the return should be cut off ahead of the kitchen sink and the return line connected into the hot water line at the tank, which will supply the sink direct through the return line. If there are other fixtures, that would be affected, it is sometimes desirable to cut the line in the attic, or wherever it may be reached, so that hot water can be supplied to the fixtures by the most direct route.

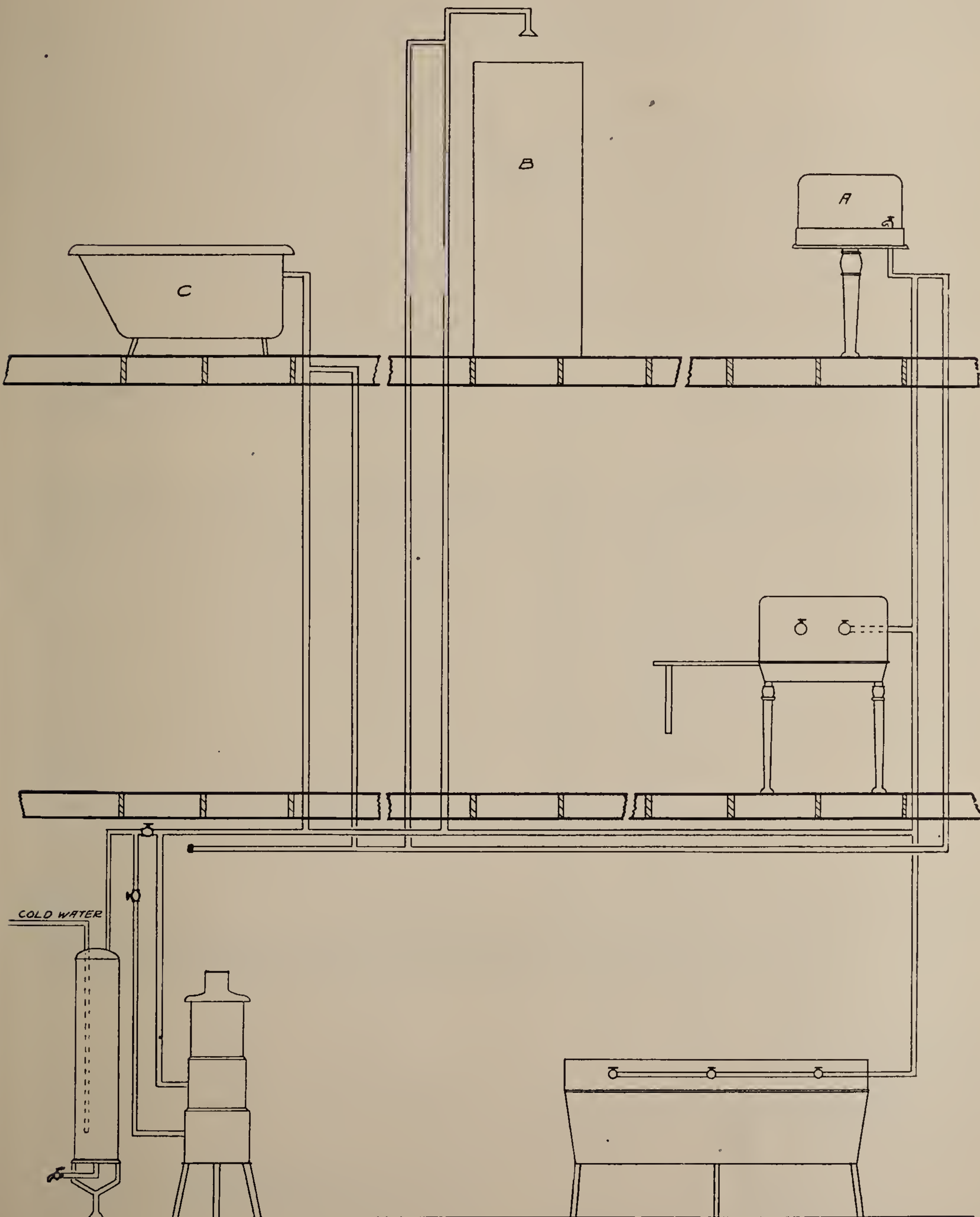

Fig. 5

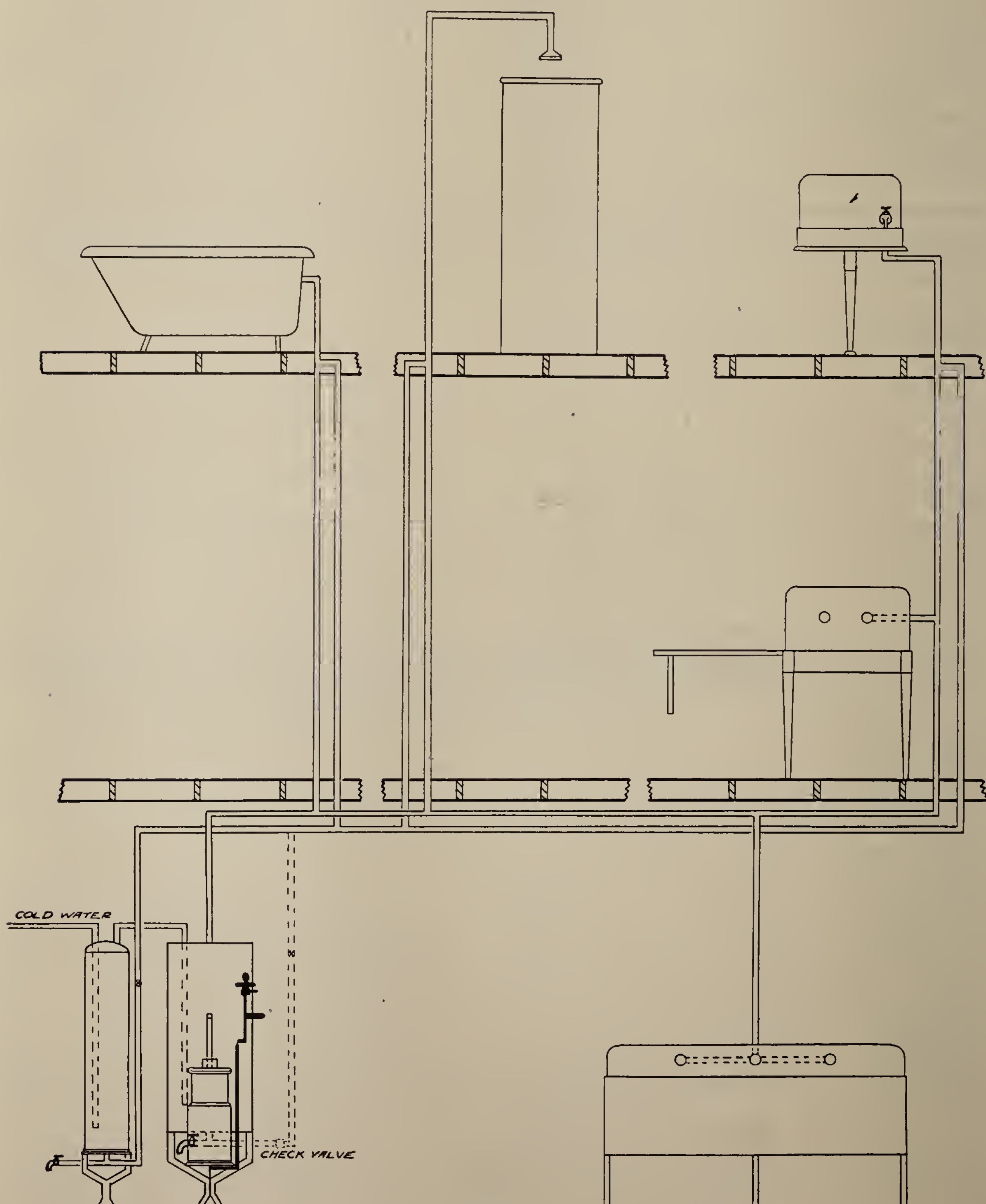

Fig. 6

Use of Tempering Tanks with Automatic Water Heaters

When a new heater is to be installed in an old house, the customer invariably asks what will be done with the water heating system in use. It has been the practice, in some localities, to remove all of the old equipment, including the tank. This, I believe, to be a bad practice, especially in relation to the tank. There is nothing to be gained by removing the tank but there is a great advantage in using it. It is desirable to install a tempering tank in a new home even if an automatic storage system is to be installed, as the cost of the tank will be saved many times over by the reduction in the gas bill.

Almost every one familiar with the sale and installation of an automatic heater knows what is meant by a tempering tank; it is simply a reservoir through which the water flows before entering the automatic, and applies to either type of system. Many of us do not stop to sum up the full benefits of such an arrangement. In all northern cities, the cold water is fed into homes far below basement temperature. This cold water in a tempering tank will absorb heat from the surrounding air at a rate sufficient to reach the room temperature in about eight hours. If the temperature of the incoming water is 38° F., as it is in Chicago in the winter, and a 40-gallon tempering tank is used in a basement that is 75° F., the inlet water is warmed 37° F. at no cost whatever. If the temperature of the water is to be 140° F., then a theoretical saving of 35% of the gas bill would be affected by the use of this tempering tank, where less than 120 gallons of water a day are drawn. Of course, the cold water does not always reach room temperature when water in large amounts is used in a short time, but it is safe to say, that in cities of climatic conditions and cold water supply similar to Chicago, a tempering tank of adequate size will save approximately 25% of the operating expense for at least six months of the year.

Another marked benefit of the tempering tank is its service as a settling chamber. It keeps large quantities of suspended matter, such as mud, sand and gravel, from getting into the heating element of a storage system. This is especially desirable when a system is used where the heat is applied directly to the bottom of the tank. In some types, it is impossible to remove all of the mud through the sediment cock. In any event, it is seldom done, due to the negligence of the owner, and the mud and sediment serve as an insulator that confines the heat to the metal with detrimental results. When used in connection with an instantaneous heater, this suspended matter is kept from entering the water valve, thus eliminating sticking and prolonging the life by reducing the wear.

Relief Valves for Safety

From a standpoint of safety, in all cases where water is heated in a storage tank, regardless of the kind or type of heater employed, a properly located relief valve should be used, where there is a water meter, check valve, or any other device that would impede relief of excessive pressure by preventing the hot water from backing up in the cold water line.

According to the laws of physics, water expands with an increase in temperature above 39° F. For example, 100 gallons of water at 40° F. when increased in temperature to 140° will in-

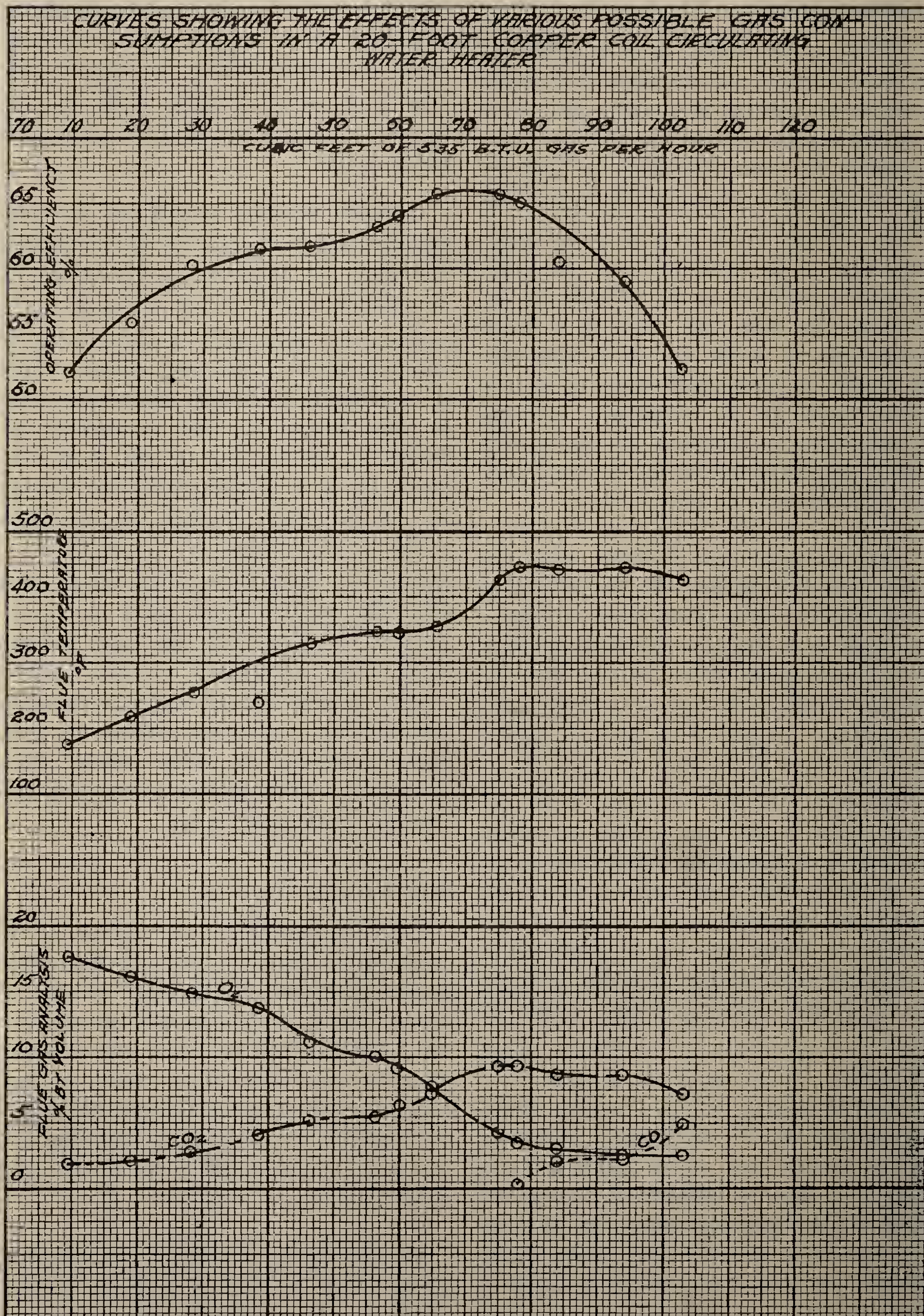
CURVES SHOWING THE EFFECTS OF VARIOUS POSSIBLE GAS CONSUMPTIONS IN A 20-FOOT COPPER COIL CIRCULATING WATER HEATER
CUBIC FEET OF 535 B.T.U. GAS PER HOUR
OPERATING EFFICIENCY %
FLUE TEMPERATURE °F
FLUE GAS ANALYSIS % BY VOLUME
CO2
O2

Fig. 7

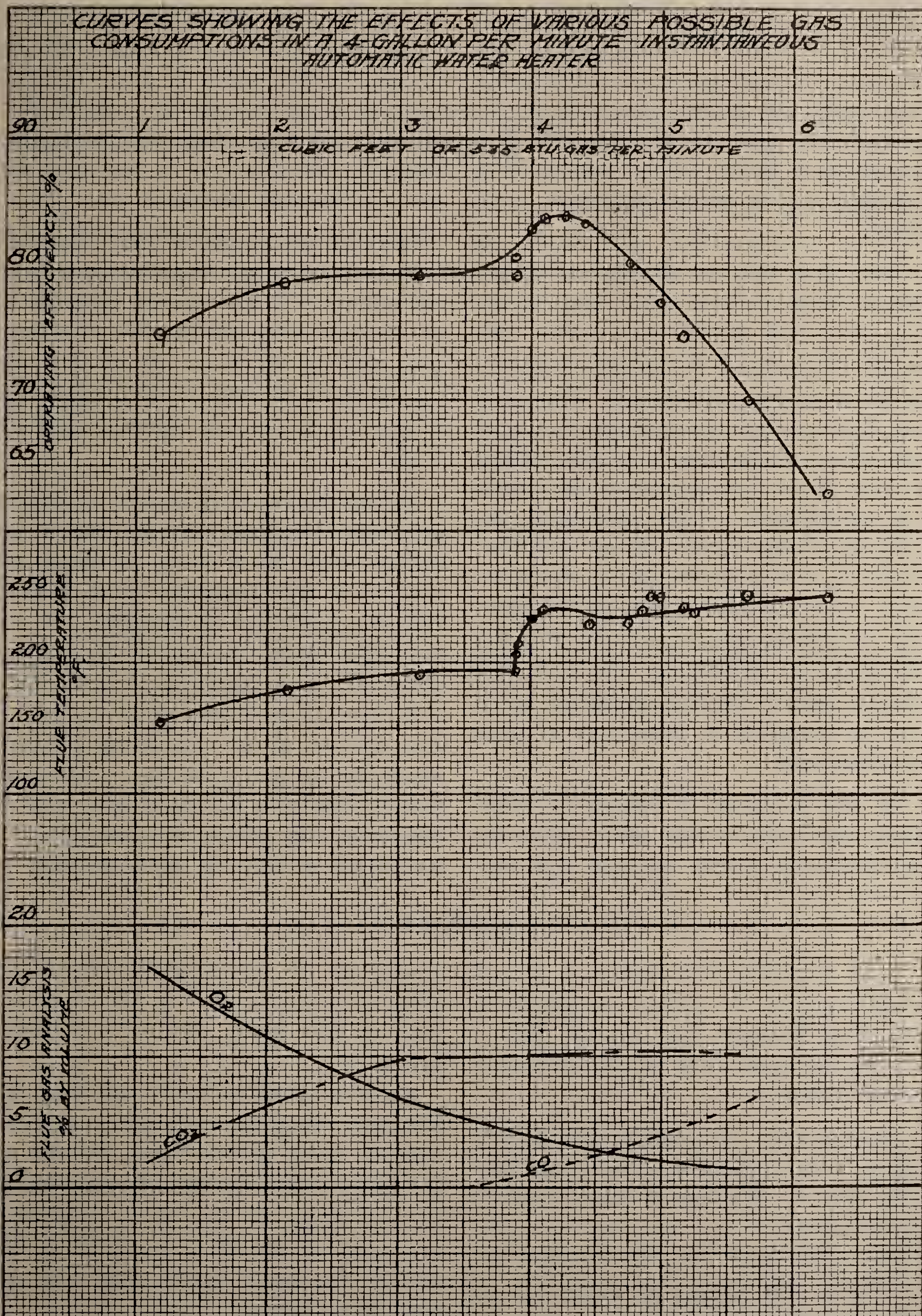
CURVES SHOWING THE EFFECTS OF VARIOUS POSSIBLE GAS CONSUMPTIONS IN A 4-GALLON PER MINUTE INSTANTANEOUS AUTOMATIC WATER HEATER
CUBIC FEET OF 535 BTU GAS PER MINUTE
1
2
3
4
5
6
OPERATING EFFICIENCY %
90
80
70
65
FLUE TEMPERATURE °F
250
200
150
100
FLUE GAS ANALYSIS % BY VOLUME
20
15
10
5
0
O_2
CO_2
CO

Fig. 8

crease in volume 1.7 gallons. Since water is practically incompressible, if there is no means of taking care of this increased volume, an enormous pressure will build up in quantity sufficient to rupture the tank or fittings, and if a temperature above the boiling point is reached, a very serious explosion could result.

The final step in making an installation which will be satisfactory to the customer and which will enable the heater to perform the service expected of it, is proper adjustment. Figures 7 and 8 prove that water heaters are most efficient when burning a certain amount of gas. Therefore, first make the proper gas adjustment. This will vary, depending on the quality of gas supplied. With an instantaneous heater, the water flow must also be regulated to obtain the desired temperature. The original thermostatic adjustment made at the factory seldom requires changing, but it can be changed, if necessary, to meet requirements.

It will be noted in Figure 7, which deals with tank heaters, that a relatively low efficiency results on both high and low consumption. This confirms the contention that graduated thermostats, when used with circulating heaters, do not permit the heater to give the most economical service except a small part of the time, as they are constantly changing the gas flow to and from the point of highest efficiency.

Member companies of the American Gas Association are urged to give careful attention to the correct installation of water heating equipment. The best gas, sold at the most attractive price, can be made of little value to customers if appliances do not operate satisfactorily.

If the customer is unable to obtain satisfactory results from the use of his water heater, he is likely to blame the quality of gas supplied, or to believe that the appliance is defective. If, on the other hand, we follow up our installations with inspections to make sure that the heater is connected so that it can operate at the maximum possible efficiency, we are rendering a courteous service that will be appreciated and at the same time adding a booster for the use of gas as fuel for water heating.

DISCUSSION

J. P. Connolly (Charleston, S. C.): I might mention the method we pursue in our New Business Department, following up the installation of our automatic water heaters.

Just recently this practice was put into effect. We follow up every installation—that is, the New Business Department follows it up. We have a fitter, taken over from the Distribution Department, who makes an inspection of all automatic water heaters after the installation is made by the Distribution Department. This fitter or inspector passes on all installations before and after they are made. In that way we find we give better service to the consumer.

Another thing we found was that the salesman going out, in a great many instances, really did not know the size of the water heater required to take care of the demand. So this fitter, inspector, or expert, as we call him, describes the size of the heater and in that way we give better service.

We follow up every installation of an automatic water heater. We keep a card

record and go around twice a year to see that the heater is working properly, and the man who goes around answers any complaints. In that way we have built up a public goodwill and boosters for water heaters.

(At the conclusion of the discussion Mr. Gould extended to Mr. Carnahan the thanks of the Section for his excellent paper.)

The next order of business was a paper "Refrigeration—A Desirable Outlet for Manufactured Gas" presented by Mr. H. DeWitt Valentine.

REFRIGERATION—A DESIRABLE OUTLET FOR MANUFACTURED GAS

H. DeWitt Valentine, Ass't Manager, Heating Division, The Peoples Gas Light & Coke Co., Chicago, Ill.

Introductory

A recent advertisement in the Chicago papers, of which a facsimile is reproduced as Fig. 1, do this paper, intensely interested a not overly credulous public. They had been very thoroughly sold to the fact that, IF IT IS DONE WITH HEAT YOU CAN DO IT BETTER WITH GAS, but the use of this very same gas to produce a condition antithetical to heat resulted in an avalanche of inquiries. For the most part, these inquiries were not indicative of the true prospect, but rather conveyed the characteristic appeal for information, ———"how is it done" "does the gas freeze," "how is cold made from heat," "where does the ice come from?" etc., etc.

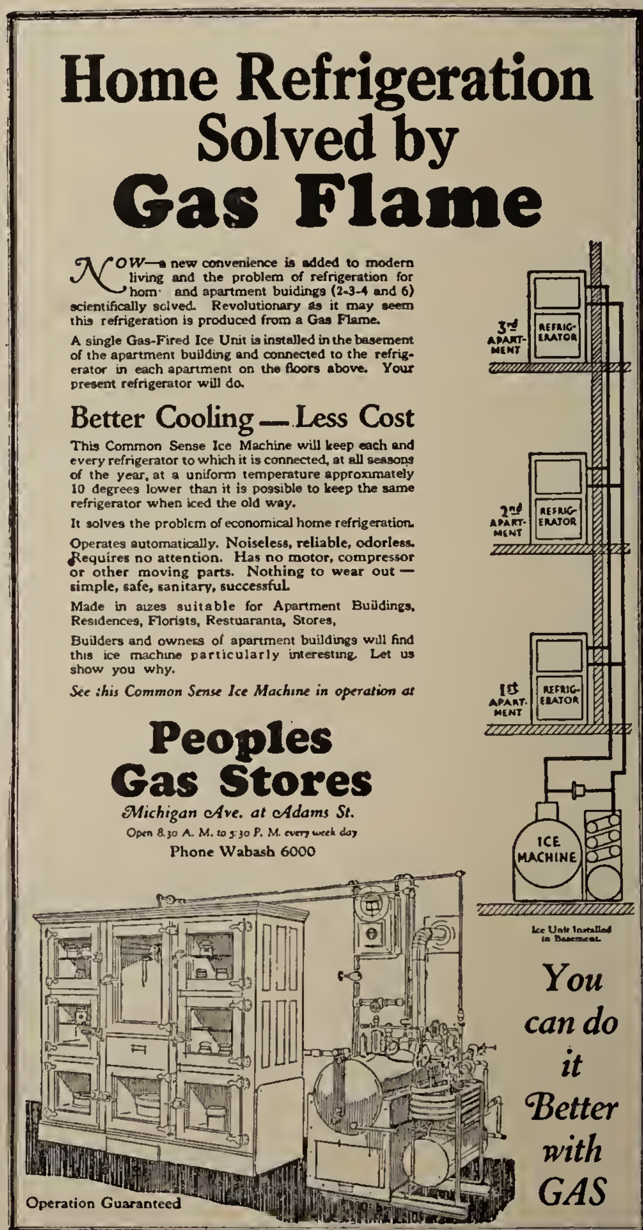

Figure 1

The average American is hungry for information, and it is necessary that this be fed to him in some form which will be mentally, easily assimilated. If not so presented, he, who is perhaps our customer, will leave badly befuddled, bored or totally unsold, as the case may be. There is no question that the degree of efficiency in salesmanship is directly proportional to the wealth of information on the appliance, process, or the service mer-

chandised and, believing that refrigeration with gas will be an important integer in the now rather concatenate activities of the modern gas company, one of the objects of this paper will be to explain, in primer form, the principles of refrigeration. This, it is hoped, will make the latter portion of the paper intelligible to the reader and that the various fundamentals covered will serve as an outline for expository sales arguments where necessary.

I do not wish to insinuate any mediocrity in mentality as far as the gas utilization fraternity is concerned, but we all are conscious of our lack of information concerning the elementary principles of even very common processes. I do not hesitate to admit that a year ago I knew practically nothing about refrigeration, and the satisfaction derived from a study of the A, B, C's of the subject prompts me to pass on the information.

The second object of this paper is descriptive of the principles of refrigeration as applied to the construction and operation of the appliance that the Peoples Gas Stores, Inc., of Chicago are fortunate to merchandise. Lastly, the relation of domestic refrigeration to the major activity of a gas company, that of selling gas for utilization is the third object of this paper.

Refrigeration and Heating Purely Relative

As regards heat content of a body, refrigeration and heating are purely relative. A refrigerator at 40° F. is decidedly hot when compared to 460° F. below zero, which is the lowest attainable temperature. At the same time, a day in August registering 108° F. is frigid when adjacent to 1800° F. produced in certain metal melting furnaces. Again, heating is popularly confined to those processes where thermal energy is added to raise the temperature above that point where we are accustomed to live comfortably, while refrigeration implies the withdrawal of thermal energy below ordinary temperatures. Here again, the terms are synonymous for, if heat is withdrawn from one body, it must necessarily be added to another and we experience a heating effect as well as refrigeration. If we forget the terms, "cool" and "cold" and define refrigeration as, "the withdrawal of heat in a space to that degree where bacterial activity ceases," then it will be a simple matter to understand clearly what is to follow.

Boiling Points, Boiling Pressures and Latent Heats

Water is a liquid at ordinary temperatures and at atmospheric pressure which is also zero pounds gauge pressure. If we apply heat to a vessel containing a pound of water we shall find that the temperature rises until 212° F. is reached. The addition of more heat does not increase the temperature but serves as the source of energy to change the state of the water from a liquid to a gas, which we call steam. This quantity of heat energy, if measured, will equal 970 B.t.u. for every pound of water at 212° F changed to steam at 212° F. Conversely, 970 B.t.u. of heat are liberated to the surroundings for every pound of steam condensed to water at 212° F.

Heat which effects a change of state in a substance is called "latent" heat to distinguish it from "sensible" heat, which can be measured on a thermometer. Latent heat can be further classified as:

A—Latent heat of vaporization (or condensation) which is defined as the quantity of heat required to change one

pound of a liquid at its boiling point to vapor at the same temperature, or, conversely, that same amount of heat which is subsequently liberated when one pound of the vapor at the boiling point is condensed to liquid at that temperature.

B—Latent heat of fusion (or liquefaction) is equal to that quantity of heat in B.t.u.'s necessary to change one pound of a solid at its freezing temperature to one pound of liquid at the same temperature. On the other hand, this same quantity of heat is withdrawn when one pound of the liquid at its freezing point is changed to a solid at that temperature.

The latent heat of vaporization of water has been given as 970 B.t.u. The latent heat of fusion is equal to 142 B.t.u. per pound.

If now the water is heated under pressure, more heat will have to be applied before the boiling point is reached, this rise in boiling point being proportional to the gauge pressure, in pounds, under which the water is being heated. For example, at 4 pounds gauge pressure the boiling point is 225° F. and at 15 pounds, 250° F. On the other hand, if the pressure under which the boiling is accomplished is below atmospheric or zero gauge pressure, then the point of boiling is reduced proportionally to the reduction of pressure as measured in "inches of vacuum." At 5 inches of vacuum, for example, water boils at 200° F., and at 15 inches of vacuum, 175° F.

Latent heat values change somewhat with pressures, but that will be omitted from our discussion, as it does not particularly concern the major operations of a refrigerating unit.

The above data is probably familiar to all because water is such a common substance. However, the effects of pressure on the boiling points of various liquids are similar, as are also the latent heat properties. The only difference is the wide temperature variations at which these effects manifest themselves. Take ammonia for example. Ammonia is a gas at ordinary temperatures and pressures, and we are acquainted with it mainly as a solution of the gas in water, called household ammonia. If, at atmospheric pressure we cool a volume of ammonia gas to 28° F. below zero, we reach the condensing (or boiling) point and will produce liquid ammonia. As the case with water, if we increase the pressure, the boiling point will raise. At 9 pounds gauge pressure the boiling point is 10° F. below zero while at 100 pounds gauge pressure it is 65° F. above zero. Decreasing the pressure below atmospheric, of course, produces the opposite effect as in the case of water. The relation between pressures and boiling points of water and ammonia are given in the following table:

WATER		AMMONIA	
Pressure Pounds Gauge	Boiling Point °F	Pressure Pounds Gauge	Boiling Point °F
26" vacuum	125	0	-28
15" "	175	3.8	-20
5" "	200	9	-10
0	212	1.6	0
4	225	24	10
15	250	33	20
31	275	45	30
52	300	58	40
81	325	74	50
119	350	93	60
169	375	115	70
230	400	139	80
415	450	168	90
660	500	200	100

Because of the fact that water boils at considerable above ordinary temperatures, it is necessary to apply the heat energy required, by burning some fuel. Ammonia, however, boiling at 28° F. below zero, will take its heat energy required for boiling from the surrounding air. Naturally, this surrounding air will

lose a corresponding amount of heat, or we say, the space will become refrigerated to a certain degree. A little illustration, Figure 2, will show this. The tank (A)

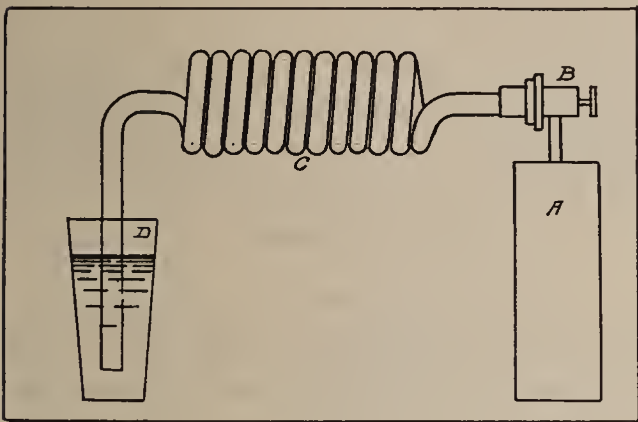

Figure 2

contains ammonia, liquid at ordinary temperatures because of the pressure under which it is confined; a valve (B) connects to a pipe coil (C) the outlet of which dips below the level of a vessel of water (D). As a small quantity of the ammonia is allowed to escape to the coil through a needle valve a white frost immediately forms on the outside surface of the coil. If the ammonia continues to pass, this coating of frost gets thicker and extends to the point where the coil enters the water. What has happened? The small amount of liquid ammonia being liberated in the coil, which is at atmospheric pressure, immediately boils, getting its heat for boiling from the air immediately surrounding the coil. Naturally, this air becomes very cold, below freezing in fact. As air always contains moisture (humidity) the air after cooling is in a saturated state with respect to this moisture and a little later supersaturated, and some of the moisture condenses out on the coil. As the surface of the coil by this time is below the freezing point of water naturally the moisture freezes.

The above little illustration is an example of perfect refrigeration, the same cycle of events, in the actual production of cold as is found in the most elaborate ice-making machines.

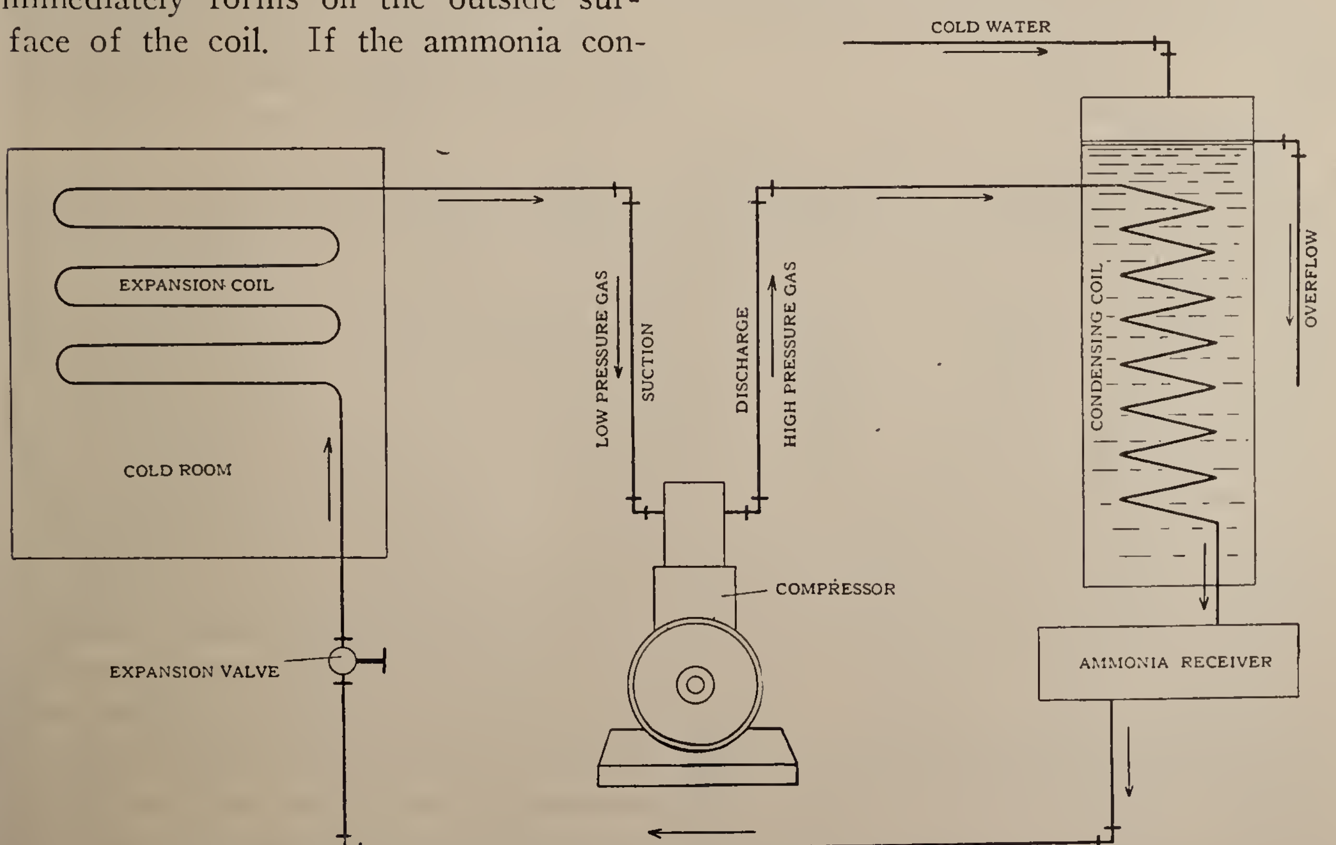

Figure 3—Diagram illustrating principle of compression system of refrigeration. .Courtesy "National Tube Company."

Ammonia is called the "refrigerant" and is more commonly used than any other, among which may be mentioned sulphur dioxide, carbon dioxide and compressed air.

In our example above, whereas we produced perfect refrigeration after we allowed the liquid ammonia to expand, it became useless for further refrigeration until reliquefied. Under certain conditions of temperature and pressure we found that this was possible and the problem of refrigeration then reduces to a method by which the ammonia will alternately vaporize and liquefy in some carefully controlled cycle.

Elementary Discussion of Refrigerating Systems

There are two general types of refrigerating systems, (1) the compression system, and (2), the absorption system.

The compression system is illustrated in Figure 3, and from our previous discussion it will be extremely easy to follow.

The liquid ammonia is kept in the receiver. The expansion valve allows the ammonia to vaporize in the expansion coils situated in the "cold" room. The heat (latent) necessary to vaporize the ammonia is taken from the sensible heat in the air of the cold room and the same frost effects become visible on the surfaces of the expansion coils that were so noticeable on the coil in our previous illustration. The low pressure ammonia vapor is sucked into the compressor from which it leaves under a pressure of about 150 pounds. From our table of pressures and boiling points we observe that ammonia at 150 pounds pressure will liquefy at 85° F. As the ammonia is hot after leaving the compressor, it is led through coils set in a running water bath. The cold water cools the ammonia under 150 pounds pressure to a point below 85° F. and liquid ammonia results, which drops back into the receiver, thus completing the cycle.

It will be noticed that in all types of the compression system some mechanical compressor is necessary, compelling the use of moving parts, which are always more or less objectionable.

In the absorption system, Figure 4, the cycle of operations is the same as in the compression system except that in the place of a compressor, an absorber and generator unit is used. This unit functions because of the combined great solubility of ammonia in water, and because the ammonia is easily and almost completely separated from the water by boiling. At 32° F. one volume of water will dissolve 1300 volumes of ammonia gas, and at 68° F. 710 volumes; that is, the lower the temperature of the water the more ammonia it will dissolve. Because of these desirable properties, ammonia is the only refrigerant used in connection with an absorption system.

Using Figure 4 as a guide, the liquid ammonia passes from the receiver to the expansion coils in the cold room through the expansion valve as in the case of the compression system. From the expansion coils the low pressure ammonia gas passes to the absorber where it is dissolved in water, kept cool by coils carrying cold running water. The concentrated ammonia liquor is pumped into the generator by the liquor pump. The generator in its simplest form is nothing more than a strongly built closed tank carrying a series of steam pipes used for heating the concentrated ammonia liquor. In the generator the ammonia is boiled off under pressure, leaving at about 100-150 pounds. Both the sensible and the

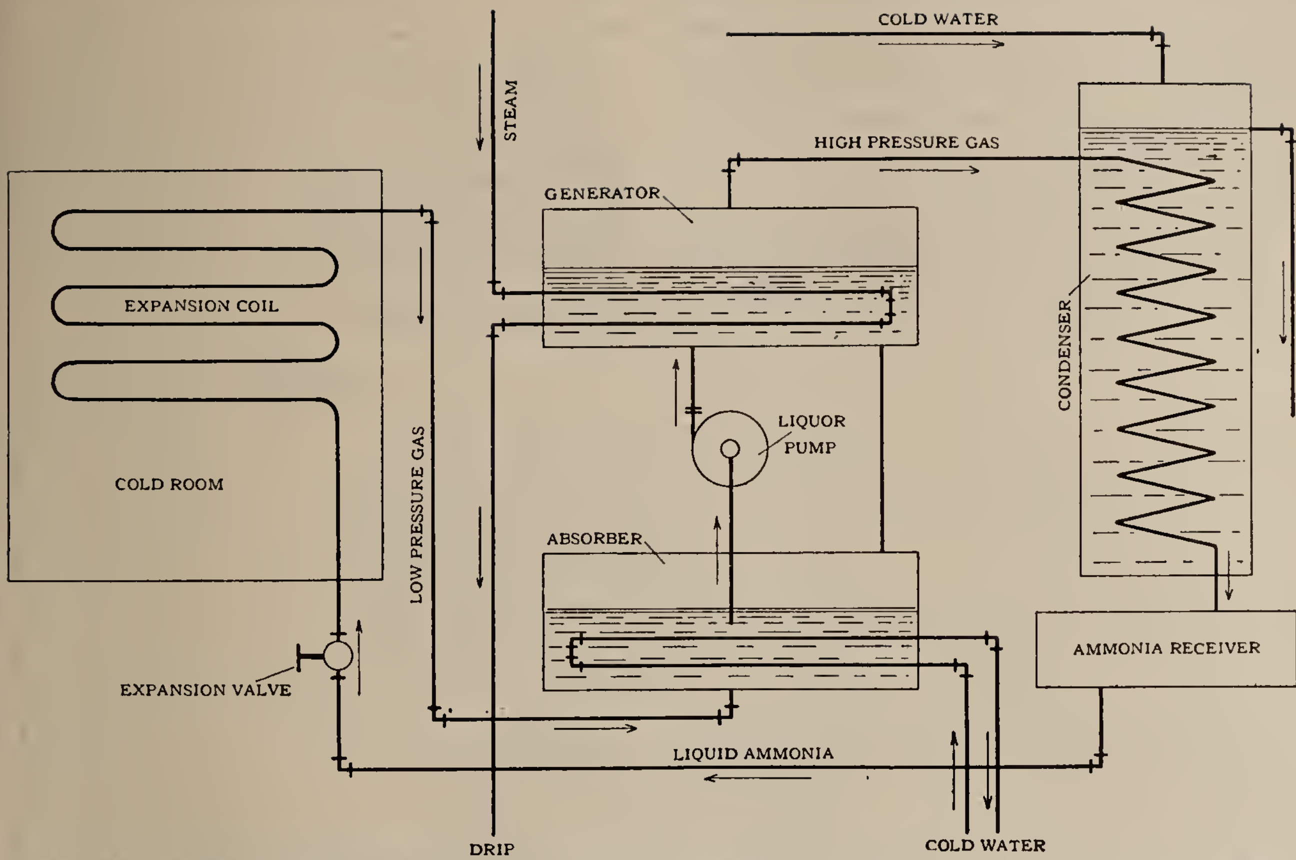

Figure 4—Diagram illustrating absorption system of refrigeration. Courtesy "National Tube Company."

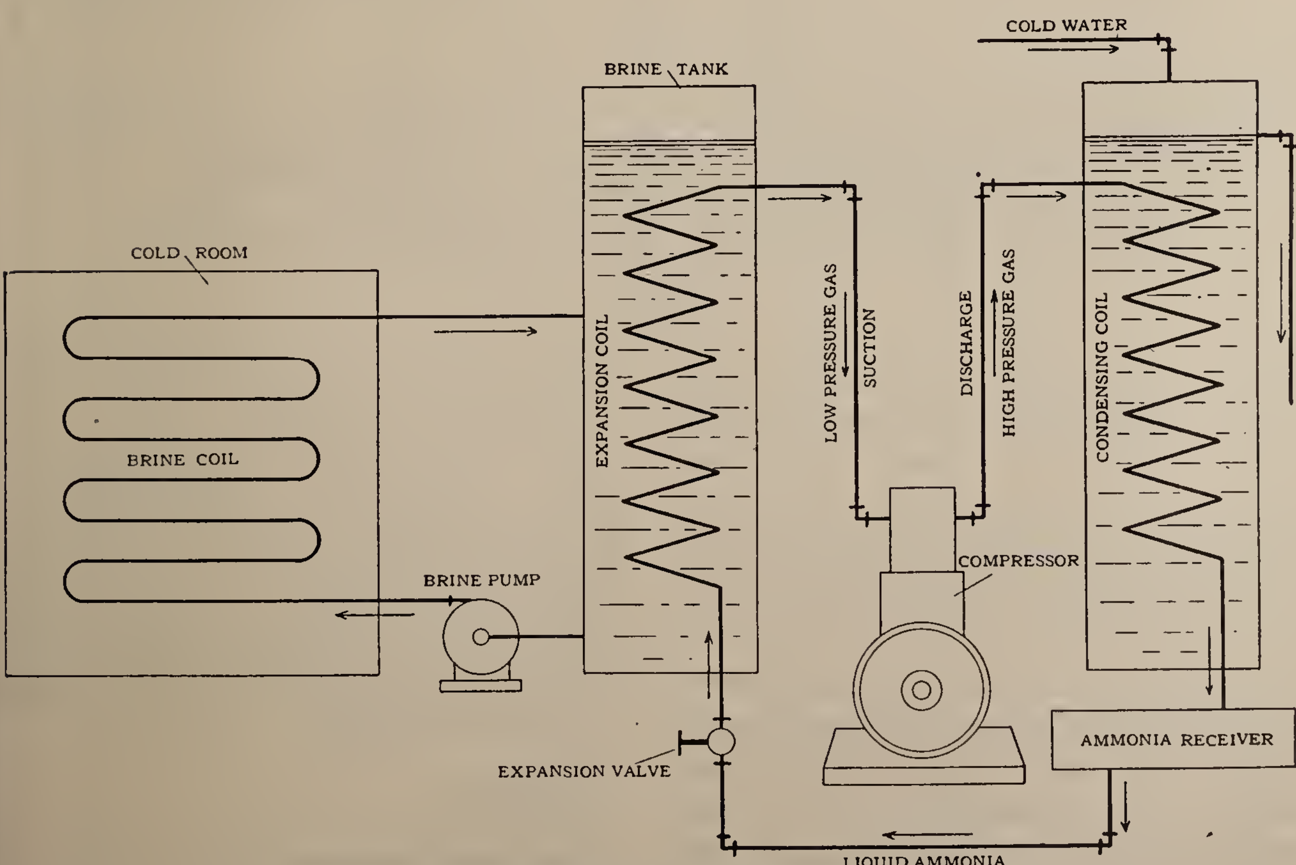

Figure 5—Diagram illustrating brine system of refrigeration. Courtesy "National Tube Company."

latent heat in the high pressure ammonia gas is removed in the condenser and the ammonia liquefies and runs back into the receiver as in the compression system. The weak ammonia liquor left in the generator flows back into the absorber.

The brine system, Figure 5, is not in reality a refrigerating system, but an chloride solution freezes at 54° F. below zero.

By this method it is possible to store a large quantity of refrigerating medium which can be pumped through coils to any portion of a building desired. The brine after its travel returns to the brine tank for recooling.

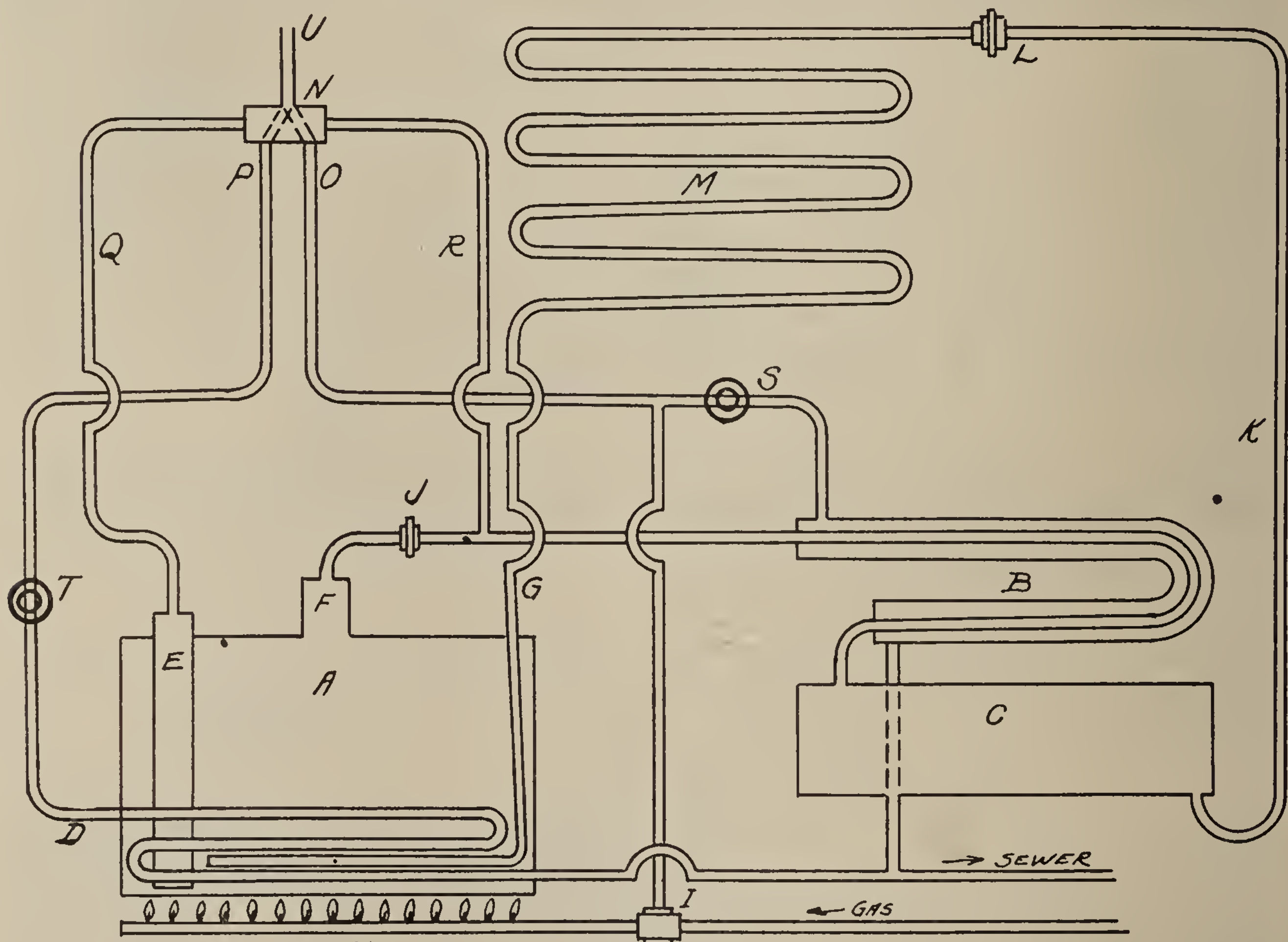

Figure 6

auxiliary equipment used essentially to carry a refrigerating medium to distant points. Instead of conveying the expansion coils directly in the cold room, they are surrounded by a brine tank. The brine tank carries water in which common salt or calcium chloride is dissolved in varying proportions. It is a well known fact that the addition of salts such as the above lowers the freezing point of the solution. For example, pure water freezes at 32° F.; a 25% common salt solution at 1° F.; and a 30% calcium

The Common Sense Ice Machine as an Absorption System

The *Common Sense* Ice Machine, the only automatically controlled, refrigerating unit using gas for the completion of its cycle, is an example of the absorption system. It is illustrated diagrammatically by Figure 6, in which the letters designate the parts as follows:

A Absorber.
B Condenser.
C Ammonia receiver.
D Cooling coil in absorber.

E Steam well in absorber.
F Steam dome in absorber.
G Return line from expansion coil.
H Gas burner under absorber generator.
I Gas valve.
J Check valve on the line through which the ammonia vapors pass from the absorber to the inner pipe of the condenser.
K Flow line from ammonia receiver to expansion valve.
L Expansion valve.
M Expansion coil.
N Shifting valve.
O Water line from shifting valve to outside pipe of condenser.
P Water line from shifting valve to the cooling coil in the absorber.
Q Pressure line from steam well in the absorber to one end of the shifting valve.
R Pressure line from the inner pipe of the condenser to the opposite end of the shifting valve.
S Valve which controls the quantity of water flowing through the condenser.
T Valve which controls quantity of water flowing through the absorber cooling coils.
U City water inlet.
V Outlet to sewer.

In the *Common Sense* Ice Machine the condenser consists of two pipes, one inside of the other. The ammonia vapors pass through the smaller inside pipe, which is surrounded by the water passing through the larger outside pipe. This condenser is known as the counter current type, that is, the flow of the water is in the opposite direction to the flow of the ammonia vapors. This form of condenser is the most efficient that it is possible to make, as the entire quantity of water passing through comes into intimate contact with the entire length of the smaller pipe through which the ammonia vapors are passing.

As the sensible and latent heats are removed from the ammonia vapors by the water passing through the condenser, these vapors are converted into liquid form and it is necessary to provide some form of receptacle in which this may accumulate. In the Common Sense Ice Machine, this receptacle (the ammonia receiver) is a small cylindrical tank into which is welded the discharge end of the smaller inside pipe of the condenser.

The cycle of operation is as follows:

A solution of ammonia and water (about 40% ammonia) is placed in the absorber, (A).

The city water, supplied through the line (U), passes through the shifting valve (N) and through the supply line (O) to the outer pipe of the condenser (B). The amount allowed to flow is throttled to the condenser, being controlled by the valve (S) and causes a pressure on the line leading to the gas valve (I), which opens this gas valve and allows gas to flow to the burner where it is ignited by the pilot light.

The strong solution contained in the absorber (A) is brought up to such a temperature that the ammonia contained in the solution commences to vaporize and passes through the steam dome (F), through the check valve (J), into the inner pipe of the condenser (B) where both the sensible and latent heat of the vapor are absorbed by the water passing through the condenser, and the vapor is converted to a liquid.

This boiling process continues until the solution in the absorber (A) contains only 18 to 20 per cent ammonia.

When this point is reached, the water is automatically cut off from the water line (O) and turned on to the water line (P) by the shifting valve (N). When the water is cut off from the water line (O), it will be noted that this dis-

continues the water to the condenser and also relieves the water pressure on the gas valve (I) thereby shutting off the supply of gas to the burner (H) under the absorber (A). When the water is shifted to the water line (P) it will be noted that it passes through the cooling coil (D), in the absorber, the quantity of water being cut to a very small amount by the control valve (T).

At the point where the shift takes place, we have approximately equal pressures in our absorber (A) and our ammonia receiver (C) but as soon as the water commences to flow through the cooling coil (D), in the absorber the pressure in the absorber immediately begins to decrease and continues to decrease until it comes down to atmospheric pressure or below. You will note that the pressure in the ammonia receiver (C) and back to the check valve (J) does not decrease but remains at a pressure determined by the temperature of the surrounding atmosphere.

The pressure in the absorber (A), having now decreased to atmospheric or less, the ammonia contained in the ammonia receiver (C) can now pass through the flow line (K), the expansion valve (L), the expansion coil (M), and the return line (G), to the absorber (A), where it is re-absorbed in the weak liquor which remained in absorber (A). The ammonia, in passing back to the absorber as described above, passes through the flow line (K), to the expansion valve (L), in liquid form. The expansion valve is so constructed that the amount of the liquid ammonia which is allowed to pass through can be regulated. As we allow a small quantity of the liquid ammonia to pass through the expansion valve to the expansion coil (M), inside of which coil the same pressure exists as in the absorber (A), (atmospheric or less), this small quantity of ammonia immediately commences to boil and absorbs the necessary heat from the material surrounding the coil whether it be air, brine, or what-not, thereby reducing the temperature of the surroundings.

The ammonia contained in the ammonia receiver continues to pass back and be re-absorbed in the weak liquor left in the absorber until all the ammonia is out of the receiver (C), when a reduction in pressure takes place in the receiver (C), which acts through the pressure line (R), on the shifting valve (N). The flow of water is discontinued through the water line (P), and caused to flow through the water line (O), thereby passing around the condenser and exerting a pressure on the gas valve, (I), and allowing a flow of gas to the burner (H), and the cycle described above is repeated.

You will note the simplicity of the entire operation; all that is required is a positive means of changing the flow of a small quantity of water, at the proper time, when certain predetermined conditions exist, from the water line (O), to the water line (P), and vice versa.

It is evident that some automatic means is necessary to change the flow of the water from line (O) to line (P) and vice versa at the proper time, in order that the machine may automatically and continuously repeat one cycle after the other; also, that we want the water to flow around the condenser and the gas to begin to burn under the absorber when all the liquid in the system is back in the absorber; also, that we wish to discontinue the flow of the water around the condenser and discontinue the burning of the gas when the ammonia contained in the solution in the absorber

has been vaporized to such an extent that the strength of the solution has been reduced to about 20 per cent.

In order to accomplish this changing of the water flow, advantage is taken of certain differences of temperatures and pressures which are automatically created at particular points in the cycle,

It is interesting to note that the shifting valve automatically acts also as a safety valve against high pressures in the generator absorber. If for some reason the ammonia vapors cannot pass from the absorber and the gas continues to burn, the pressure in the absorber will rise above normal; as the pressure in the absorber continues to get higher,

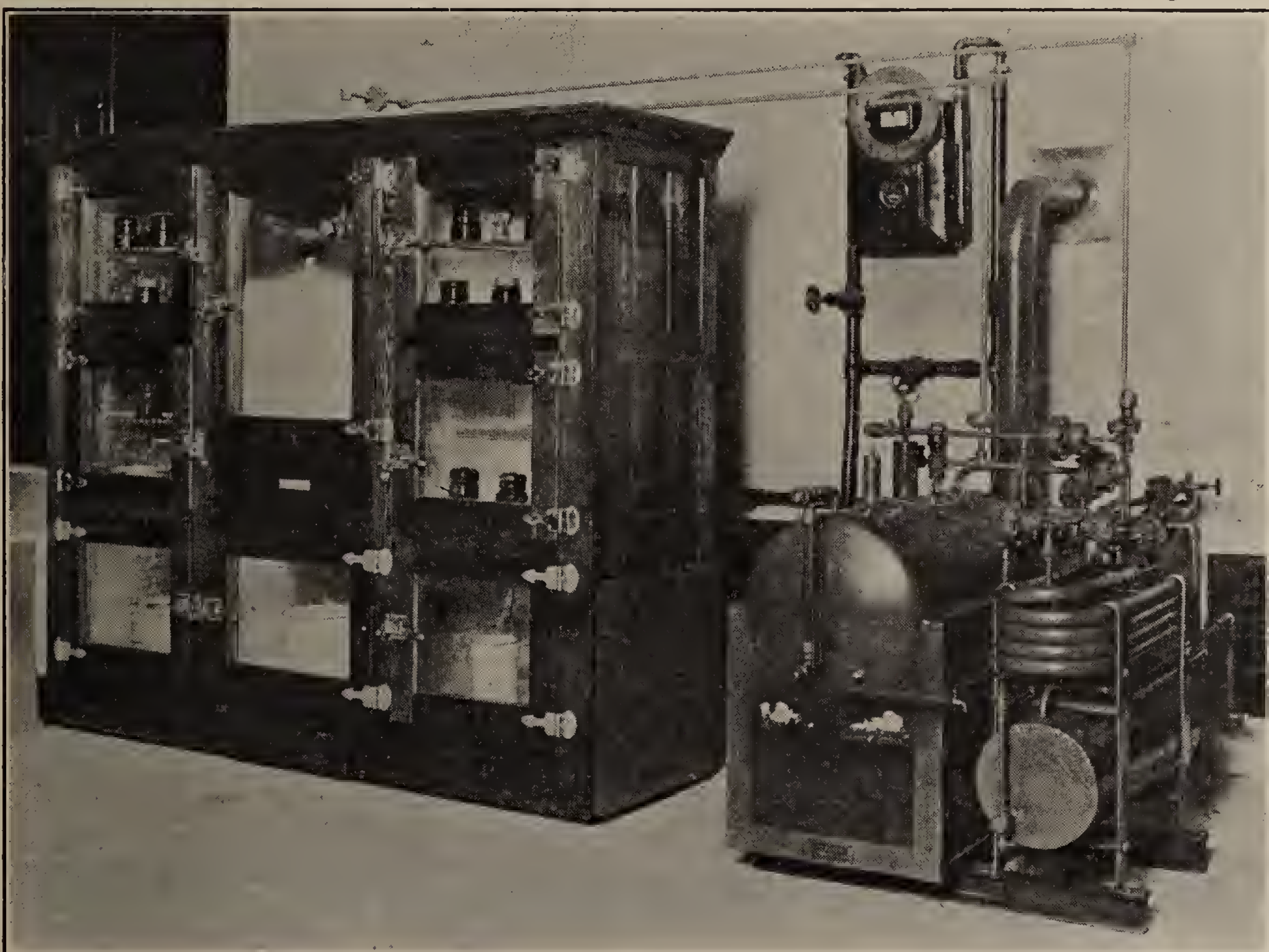

Figure 8

which differences are applied to a specially designed three-way shifting valve mechanism, the principle and construction of which are entirely original. The action and positive operation of this valve have been likened by several engineers to the valve which is the principal component part of the Westinghouse Air Brake System, universally used by railways all over the country.

the temperature increases proportionately and eventually will reach a point where a sufficiently high temperature is attained to cause the valve to shift and cut off the gas.

Figure 8 shows the appliance, photographed in actual operation. It is unfortunate that there is no diagram available intermediate between this and

Figure 6, as at first glance it is difficult to associate the two. The reason for this is the unusual compactness of the appliance with the result that each small fitting stands out in glaring over-importance. A little scrutiny however will satisfy the reader that the simplicity of Figure 6 can actually be extended to include the design of the apparently formidable photograph.

It is necessary, before rating these machines, to define the unit of refrigeration. One ton of refrigeration is that amount of heat absorbed by the melting of 2,000 pounds of ice at 32° F. into 2,000 pounds of water at 32° F. or the amount of heat that must be subtracted from 2,000 pounds of water at 32° F. to reduce it to 2,000 pounds of ice at 32° F. This is equal to 2,000 $\times$ 144 or 288,000 B.t.u.'s.

The *Common Sense* ice machine is made in three sizes which are rated at 125, 250 and 500 pounds of refrigeration per twenty-four hours. In other words this may be stated as one-sixteenth, one-eighth and one-quarter units of refrigeration per twenty-four hours. This rating is based on four complete cycles every twenty-four hours.

An important item, that of safety, is probably uppermost in the minds of the greater part of the readers. No safety devices have been shown in the diagrams because of the confusion that might arise from the use of a complicated drawing.

There is no doubt that, even though, as is the case with the appliance under discussion, all parts are tested under a pressure of 1,200 pounds, a continuous generation of heat under the absorber-generator would accumulate an excessively high pressure which in turn could cause an embarrassing situation. Obviously, the safety attachments must be connected in series with the gas line and also must be placed on the high pressure side of the ammonia line. The first device is a pressure regulating valve of the throttling type and is placed in the gas line just adjacent to the gas valve (I) Figure 6. When the pressure in the generator reaches 190 pounds the throttling begins, and reaches its maximum effect when the pressure attains 230 pounds, at which point only enough heat is supplied to counteract the radiation loss from the surface of the generator. Connecting directly to the generator is a safety valve. It carries the same pressure as the generator and if the pressure should reach 300 pounds the valve unseats and the excess pressure, together with ammonia gas, bleeds off to a sewer connection. A similar valve is placed in direct communication with the ammonia receiver and acts as a safeguard in case of fire.

The three sizes of *Common Sense* ice machines operate on 45, 90 and 150 cubic feet of gas per hour. The amount of water used is a variable depending upon the time of year and the temperature of the water. The average in the larger machine is approximately five pounds per minute.

Refrigeration and the Manufactured Gas Load

A great many gas men are continually striving to take the peaks off their sendout. It seems to me that it would be far better to fill up the valleys. There is no question that a sendout which contains a constant seasonal load is an excellent indication of merchandising efficiency. The lighting load is almost nil; the industrial and cooking business is, as a seasonal load, fairly constant; water heating and house heating are the two great variables.

Figure 9 represents a series of curves to illustrate the importance of the refrig-

erating load. The curve G-E-B-C-F-H designates the mean average temperatures over the twelve months as existing in Chicago. It is assumed that when the temperature reaches 60° F. artificial heat has to be supplied. That means that the heating season, in Chicago, begins about September 15 and terminates around the first part of May. The area A-G-E-B plus the area C-F-H-D then is directly proportional to the total amount of heat supplied during the heating season, or also, to the total amount of gas burned for heating purposes, assuming that gas is being used for that purpose. From the first part of May then to the fifteenth of September, at the present time, it is necessary to be satisfied with the water heating load. It is ture that this is heavier during the summer months than in the winter, but not heavy enough to prevent a decided valley between the points B and C on the curve. It is refrigeration by gas which materially helps to fill up the valley. It is however difficult to accurately gauge the amount of gas used over a refrigerating season, and I suppose that the following will be more or less painful to a refrigerating engineer who regards assumptions as somewhat indiscreet. However, if we asume an average refrigera-

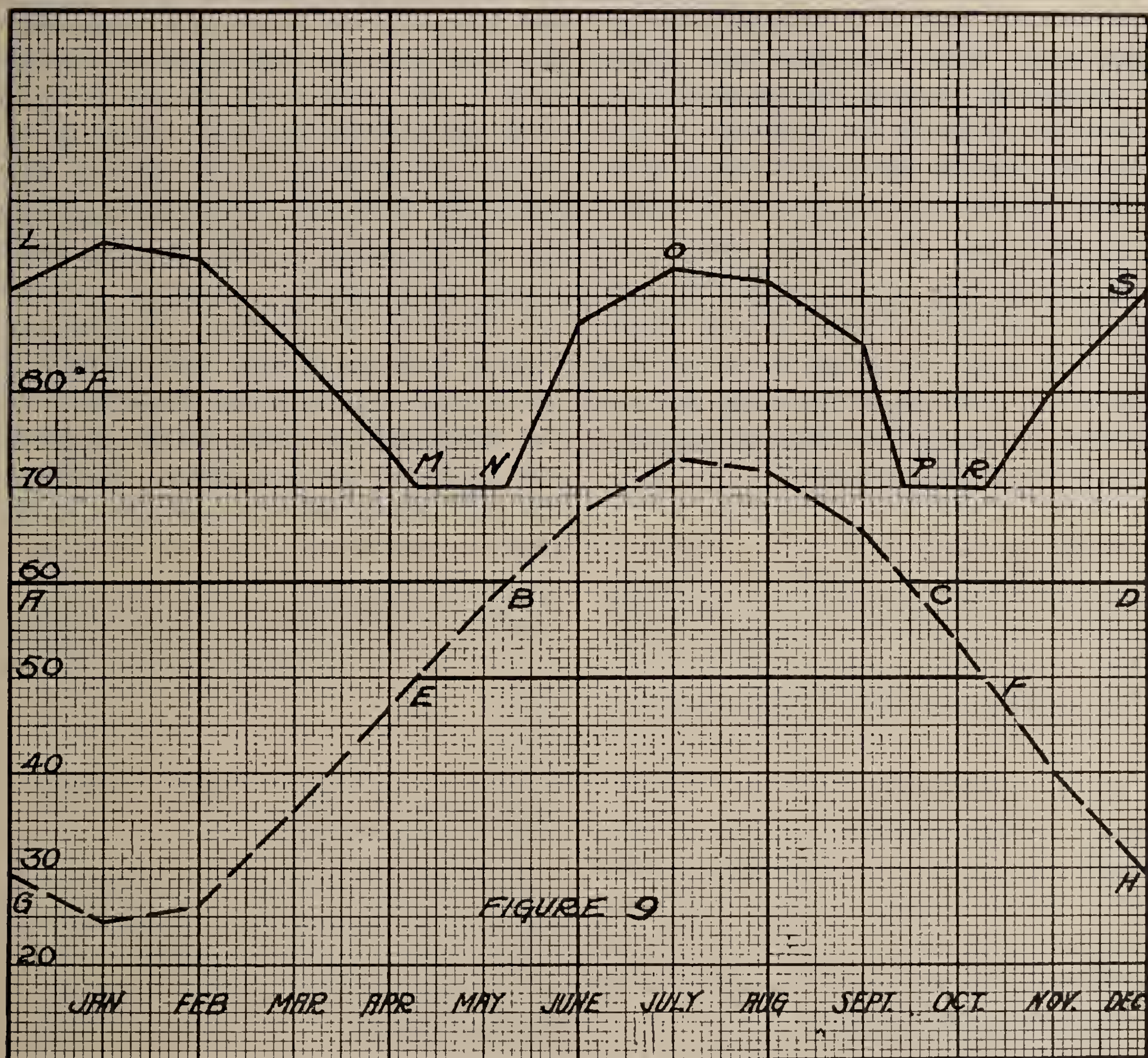

Figure 9

tor temperature of 50° F, the quantity of ice melted per unit of time will be proportional to the difference in temperature between 50° F. and the existing temperature outside of the box. The amount of ice melted then can be represented by the area E-B-T-C-F, and conversely the amount of ice manufactured during the refrigerating season is measured by the same area. Again this same area, slightly modified because of technicalities which are relatively unimportant in connection with this paper, can be said to indicate the gas consumption for refrigerating purposes during this period. It is noticeable that the two areas, the heating and the refrigerating, overlap slightly. This is not surprising as we all have heard that startling overture by an irate housewife, "here I am buying ice and I have a fire in the furnace."

Using the line A-D as an arbitrary base and adding the heating and refrigerating curves we get the resultant curve, L-M-N-O-P-R-S, in which L-M and R-S are purely heating, N-O-P is entirely refrigeration and M-N and P-R represent mixed loads. It is evident that refrigeration with gas is a decided factor in filling up the summer valley.

Conclusion

Although refrigeration with gas may seem far off to many readers, yet is it not true that five years ago house heating with gas was held similarly "in the blue"? We in Chicago expect to do a tremendous house heating business in the future; we have made an excellent start this year; at the same time we have more than doubled the water heating load. There is no problem, however formidable, that can not be solved, if the organization confronted with that problem is thoroughly sold as to the importance of the issue and the value of the weapons they must use for its solution. Refrigeration is just as much a problem of the proper application of heat as is cooking and house heating and therefore AS IT IS DONE WITH HEAT IT CAN BEST BE ACCOMPLISHED WITH GAS.

DISCUSSION

Chas. A. Monroe (Chicago, Ill.): I would like to ask Mr. Valentine if the paper gives a summary of the installations, as to domestic and commercial? And I would like to ask you if you could tell us right now if any of them are domestic installations?

H. DeW. Valentine (Chicago, Ill.): I would rather not answer that just now. I think they are about 25% commercial and 75% private. I have got the figures at the hotel.

I have also not given the capacity of these machines. They can be made in any capacity. At the present time there are three sizes.

Member: I would like to ask Mr. Valentine, of the 21 systems installed in Chicago, how many of those have gone through the winter?

H. DeW. Valentine (Chicago, Ill.): Of course, the domestic machines will not function during the winter, but I believe the other ones will function all the year round.

Member: When you put in your installation do you sell the complete installation, or do you take the ice box that is there and apply the apparatus to it?

H. DeW. Valentine (Chicago, Ill.): We apply the apparatus to the existing ice box. That is one great feature of it.

Chas. A. Monroe (Chicago, Ill.): Does the paper quote the prices of the various sizes of machines?

H. DeW. Valentine (Chicago, Ill.): I have endeavored to keep it as far as possible from a commercial paper. The only place you could get that information would be from the Common Sense Ice Machine Company, in Chicago.

Chas. A. Monroe (Chicago, Ill.): Are they prepared to merchandise this now?

H. DeW. Valentine (Chicago, Ill.): Mr. Knight is observing these machines at close range, where he can go around and supervise the installation. He will not let these machines go into territories beyond that point until some company takes enough interest in it to go into the matter thoroughly enough to merchandise it. He is very conservative. He is going to have an excellent machine before he lets it go out. I think within the next few months you will get something definite on it.

I have just given you this paper to show you that, "If it can be done with heat it can be done better with gas," and what we have started to do now will undoubtedly grow in the next few years.

(A vote of thanks was extented to Mr. Valentine by the Chairman in behalf of the Section.)

REPORT OF COMMITTEE ON COOPERATION WITH THE PLUMBING AND HEATING DEALER

F. H. KNAPP, *Chairman*, Pittsburg, Pa.

BEFORE I make my report in detail, I want to read to you the names of the gentlemen who have been associated with me in this work during the past year:

F. A. Woodhead, Arlington Gas Light Company, Arlington, Mass.

E. A. Willard, Portland Gas Light Company, Portland, Me.

E. W. Allen, Lynn Gas & Electric Company, Lynn, Mass.

R. A. Koehler, Public Service Gas Company, Newark, N. J.

J. H. Dill, Consolidated Gas, Electric Light & Power Company, Baltimore, Md.

Arthur Friedman, Cleveland Heater Company, Cleveland, Ohio.

W. E. Derwent, Geo. D. Roper Corporation, Rockford, Ill.

About a year ago this month, the first meeting of the Commercial Section was held, and Mr. Gould appointed this committee and made me chairman.

The first actual work along the lines of cooperation between the plumber and the gas companies was done when I attended a convention held in Evansville, Indiana, called by the Trade Extension Bureau, an organization underwritten by the jobbers and manufacturers of the country, and attended by the plumbers. There were 85 secretaries there from cities as far west as California and from many cities of the east.

Now, 85 does not seem very many when you compare it with the 4,000 we have at this convention. But we had 85 secretaries of the Plumbers Association get together for the first time in their lives to discuss real practical questions, without all their membership present. They really had an interest in what they were going to do.

When I found out that that meeting was to take place, I thought it would be a help in the work I was doing for me to go down there and tell them frankly what we hoped might be brought about during 1923.

I might state that I was received very cordially. Some very personal questions were asked, which I tried to answer, and those I could not answer I took up with the gas companies who were interested.

Following that I had a request, through the Secretary of this Association, to appear before the Master Plumbers National Convention in Atlantic City in June of this year, in order that there might be no misunderstanding on the part of the plumbers as to just what this committee suggested might be done. I want you to bear in mind that I made it very plain to them that I could not assure them that any or all of the things could be done, but that at least some of them would be done.

We had our opinions and our suggestions printed. It is not very long and perhaps some of you have not heard it, so I will read it to you.

GAS COMPANY AND PLUMBING DEALER CO-OPERATION

THIS IS BY NO MEANS a new subject but it is of sufficient importance and far reaching influence as to be worthy of special attention.

A co-operative arrangement between the gas company and the plumbing dealer must assure reciprocal benefits, and profitable and increased sales for both.

A mutually satisfactory agreement would, in its practical application, tend to

1. *Increase the volume of gas appliance business for the plumber and the gas company.*

2. *Eliminate the sale and installation of cheap and inefficient appliances.*

3. *Establish in the minds of the public a higher regard for gas service and standard appliances, and confidence in the merchandiser.*

Safety is a most important factor in connection with the selection and installation of gas appliances. There should be a clear understanding between the gas company and the plumber as to approved and safe methods of installation and agreement should be reached with respect to whatever rules may be adopted governing the question of flue connections. Attention is also directed to the importance of offering nothing but standard appliances — quality merchandise — at prices which will be fair to the public and allow the seller to recover his necessary costs plus a legitimate profit.

The Gas Company is in a position to offer the plumbing dealer,—

The assistance of its salesmen to help close dealer sales,

The loan of suitable stock for the dealer's window display and show room,

Assistance in preparing window displays,

Sales literature imprinted with the dealer's name,

Appliances from stock at prices which will enable the plumbing dealer to meet his overhead and make a fair profit.

The Plumbing Dealer in return should,

Agree to handle only standard appliances or such as are built to present or subsequent A. G. A. Specifications,

Make installations, particularly of automatic water heaters, in accordance with the gas company's approved practice,

Follow the gas company's rules for the piping of buildings and homes.

The human equation is the decisive factor in the satisfactory operation of any co-operative arrangement, and even among competitors we find their business relations more harmonious when the individuals are acquainted one with the other,—so it must be in this case.

The responsibility of initiating the move for these two interests to co-operate and work together is shared equally by the gas company and the plumbing dealer, but for the purpose of making a start we will assume that the former will take the first step.

The Secretary of the local chapter of the Master Plumbers Association, wherever such a group exists, as well as each individual plumbing dealer in the community should be interviewed, the advantages of such co-operation explained to them, definite assurance given of the company's willingness to co-operate, and an invitation extended to attend a subsequent meeting of all the plumbing dealers and gas company representatives for further discussion of the subject and to perfect a working organization.

A special effort should be made to have present at this first meeting every plumbing dealer in the community. The gas company should be adequately represented by the management, the head of the Sales Department and members of his organization, as well as other departments.

Make clear the purpose of the meeting and remove any differences which may exist between the company and the dealers. There can be only one reasonable basis for co-operation of this character; it must include fair minded consideration of the interests of each side and result in tangible benefits to both.

This Committee cannot suggest a detailed plan which would be operative in every situation. Local conditions and policies vary to such an extent as to make this inadvisable. There are, however, several working agreements in operation between gas companies and their local plumbing dealers, the results of which have proven that such a plan is feasible and distinctly to the advantage of both interests and the public. The following may be referred to in this connection:

*F. A. Woodhead, Arlington Gas Light Co., Arlington, Mass.

E. A. Willard, Portland Gas Light Company, Portland, Me.

*E. W. Allen, Lynn Gas & Electric Co., Lynn, Mass.

R. A. Koehler, Public Service Gas Company, Newark, N. J.

J. H. Dill, Consolidated Gas, Electric Light & Power Co., Baltimore, Md.

W. W. Flanders, Tacoma Gas Company, Tacoma, Wash.

Representatives of the American Gas Association have appeared before the members of the National Association of Master Plumbers and the secretaries of its local chapters, and in turn the members of the American Gas Association have been addressed by representatives of the Master Plumbers Association who publicly expressed on behalf of their respective associations the hope for a better understanding and close co-operation of these two interests.

Your committee is strongly of the opinion that the adoption of these recommendations will be of real benefit to the gas companies, the plumbing dealers, and the public, and that steps should be taken to perfect the necessary arrangements to put such plans into effect in every community.

Following the reading of this plan, very fortunately for us, there were two very clever speakers, who commented on what I had said and what I had offered to do, and that helped to put the thing over in very good shape.

Since that meeting in June, I have called on the president of the Master Plumbers Association, who lives in Newark, for the sole purpose of asking him just how far, to his knowledge, this

*Gas Age-Record issue of January 20, 1923, pages 81 and 95 contain further information as to the Lynn plan, and the plan in effect at Arlington is described in a paper by Mr. Woodhead presented at the January meeting of the New England Association of Gas Engineers.

plan had worked out. He said, "The best I can say for you, Mr. Knapp, is that we haven't had any complaints. The only city that I really know about is the one in which I live, Newark, and everything is satisfactory for the plumber here regarding his connection and association with the gas company."

Of course, there has to be a little fly in the ointment. Two days after I was there I got a request from the Plumbers Association of Greater New York to meet their committee and talk over their troubles in New York City and outside of New York City in what is known as Greater New York. I was very glad to accommodate that committee. They came to Atlantic City on Monday morning, met me at my hotel, I spent two hours with them, brought them up to this exhibit and took them through, and when they left they were happy. They had learned a lot of things about gas appliances that they did not know before they came. They felt better disposed toward the gas association, and I am quite sure that will bring good results.

I hope every gentleman in the room who has a thought on this subject will say something, following the report I have made.

The Chairman: We thank you very much for that report, Mr. Knapp, and I am sure some of the gentlemen here will be very glad, indeed, to give their experiences in a very practical way, as has been suggested, regarding this cooperative movement.

DISCUSSION

F. A. Woodhead (Arlington, Mass.): I do not know that I can add very much to this report. We are starting now on our fourth year in the matter of cooperation with the plumber, and it is very difficult to show any definite, tangible results. But we are perfectly satisfied with the results that have so far been accomplished.

I heard a story this morning that I think might be passed along to you. A sausage manufacturer was arrested for speeding. The judge said, "What kind of meat do you put in your sausages?" "Good meat; very good meat." "What kind of meat do you use?" "Rabbit meat." "Do you use all rabbit meat?" "Well, no, I use just a little horse meat." "How much horse meat do you use?" "Oh, about fifty-fifty." "What do you mean by fifty-fifty?" "Why, one horse—one rabbit."

Now, that applies to this movement. If it is to be a success, the gas company will have to put in the horse part of it, the plumber put in the rabbit part.

E. A. Willard (Portland, Me.): We have worked on this proposition for some time and we have found that it takes a lot of hard work, patience, and costs money. But up to the present time we are very much pleased with the results, from the efforts put into it, and we think that the money we have expended has been well spent. We are entirely satisfied.

The Chairman: Gentlemen, you heard in the previous paper something about red figures. I think at the present time, regarding this antagonism by the plumbers heretofore, as shown by red figures, that whenever we have any red figures on any other account, the great idea is to check the red figures with the black figures. Now, even if we cannot go so far as that, we would make a great step forward if we could just cut out the antagonism that heretofore the plumbers

have shown toward the gas companies. And if that is done, you will begin to show black figures in the results that will be attained by this cooperation.

I think it is most important that this association carry on the work that has so efficiently been done by Mr. Knapp and his committee.

I might say here that the pamphlet that he quoted from has been distributed to all gas companies, with suggestions that can be used by any of the gas companies to their profit. If there are any of the gentlemen who wish extra copies of that, the Association will be glad to send them to you.

W. R. Lacey (Milwaukee, Wis.): We have tried very hard in the last three or four years on this plumber cooperation proposition, and I think we have gone as far as any other company that I have heard of. We are cooperating with them by buying our heaters in very large quantities and selling them at a reasonable price to the plumbers. We do that on the tank heater line, in order to sell more tank heaters, and we sell a better grade of tank heater than they usually handle.

We have been cooperating by jobbing and through advertising. Every bit of our advertising on water heaters, whether it is billboard or hand bills or newspaper advertising, carries at the bottom, not just our name, but all of the plumbers and the Milwaukee Gas Light Company.

We have been loaning them material for window displays and helping them to display. We have been helping them to make sales. This year we instituted a plan for carrying a time payment account on heaters, whereby the plumber receives his connection charge and his commission of twenty and five for every automatic heater the first of the month after the heater is installed, and we make the balance of the collections. I might say that we put in three heaters that way this year. But it did not go very well. It did not take.

As to the results. We have found, as no doubt everyone else has who has tried it, that the plumber is not a salesman. We find him to be more of the professional type of man who sits back and waits for somebody to call him in and ask him what to do. We have found that to be true in all of our efforts to cooperate with him—that he is a professional type of man and not a salesman. We have got to do the selling.

Our main effort now is not to try to make the salesman or the merchant come to the plumber, but to give him a better understanding of the water heater situation, thereby making his advice, when he is called in, more valuable and more sound. We have found him to be not the highest type of professional man. The thing that interests him is not so much the real need of the customer, but rather the dollars and cents that go into his pocket. We find that where the commission on a coal heater is larger to him than on an automatic heater or gas heater, he recommends the coal heater.

We happen to be selling a storage heater at a very reasonable list price. There are other heaters being sold in the city at a considerably higher price. We had one installation of four heaters to go into an apartment building, and the owner was in our office, after having seen the other heaters, and he said, "This is the heater I want." He turned to the plumber and said, "What do you think about it?" The plumber had, back in his mind, the thought that if he put in our

heater he would get a certain amount, and if he put in another heater he would get $65 more. He did not think anything at all about the fact that the owner would have to pay $270 more to put in the other kind of heater. So, of course, he recommended the higher priced heater, without any regard to the real needs of his customer.

I cannot say that we have gotten very far with the plumber. But we have gotten a little cooperation with the plumber, and even a little cooperation with that class of men can do so much for us. And we intend, Mr. Chairman, to continue with our efforts in cooperating with the plumber to the fullest extent.

I might say one other thing. We have attempted to work with the plumbers in the establishment of a price on tank heaters connected. I think that that has not been the case in a good many situations where the gas company has put on a sale, at a reduced price, of tank heaters. We have not done that, but have maintained the price throughout the season.

J. P. Hanlan (Newark, N. J.) : By way of endorsement to Mr. Knapp's contribution to the Association, Mr. Koehler is a member of this committee, and Mr. Koehler is very partial to the plumbers. He has a host of friends among the plumbers.

As far as we are concerned, we try to cooperate with the plumbers to the extent of one horse and one rabbit.

Our company has spent its money to create a demand for gas appliances, and I do not think any plumber will say that there has ever been a demand for gas appliances that he has not cashed in on. We are willing to have him cash in on the demand, and we are willing to go along and share the results of our efforts with him.

We try to help the plumber in every way. If the plumber is working on a job and he gives us any kind of a square break at all, we work with him. Our men will go out and help him close sales. Our men have closed lots of sales for plumbers. We pay our men as much for plumber's sales as for any other sales. Therefore, the man has no incentive to work against the plumber.

Sometimes we do advertising directly for the plumber in order that he may see where there are avenues for increasing his income. I do not know that this is particularly new, but the idea was suggested to me a few years ago by a young fellow who has since died, and we are using it now. He wrote a series of ads for us, somewhat along this line: "When you go in to repair a faucet, there is not much money in that, but you may be able to sell the woman a gas water heater. Confer a good turn upon your customer and make some money. And along that line, do some work in the bathroom. Bring home the thought about the automatic type of water heater. And likewise, if there is something wrong with the heating plant, why not supplement it with fireplace heating?"

It is unfortunate that some plumbers do not really know the possibilities. I guess that is our fault more than theirs. They do not know the possibilities for profit and for the service that they can avail themselves of in tying up with the gas company in its work.

I heard a plumber in Philadelphia talking about the same old story that we get—the gas company did not cooperate with him. I said to him, "Why, do you know you would make twenty-five dol-

lars or more than that on fireplace heating? Do you know you could make fifty to a hundred dollars on a gas range?" He did not believe it was possible.

Well, as long as the plumbers are greedy and as long as we are greedy, I guess we will have to struggle along with this problem like a good many other problems. We need their help, and I think they need ours, and I think that if we can get down to a basis that will be profitable to both of us, it will be a good thing.

The Chairman: Mr. Knapp, I thank you very much for your presentation and report.

Gentlemen, it is very late, but there is just one more word I would like to say to you. That is, is there anyone here who has a constructive suggestion to offer to the Commercial Section in regard to its activities for the coming year?

We, of course, have been and will continue to be influenced by the demands made upon us as to what activities we should take up and what subjects should be discussed and what reports to make. We are not making, in every case, the reports that we, as individuals, always like to make. We are your representatives, and consequently, are giving you the reports that we know you desire.

Is there any gentleman in the room who has any constructive suggestion to make regarding the coming year's activities?

J. P. Hanlan (Newark, N. J.): Mr. P. S. Young delivered a message yesterday before the general session, and I am wondering whether there were not some things in that message of his that we might consider.

For instance, one thing he said was that he thought that we ought to have a commercial policy committee of the Commercial Section. But I have seen in other sections or other societies where the commercial section was trying to sell itself to the management. I am not going to try to sell the Commercial Section to the management. If they cannot see it, I am not going to waste time trying to sell the Commercial Section to the management. But if a big man in industry comes along and says, "You ought to have a commercial policy committee," I say that suggestion is worth while listening to.

I heard another man—and he is a big man in the industry—say, "Well, we thresh over the same old things in the Commercial Section, year in and year out." Well, I do not know if we have anything else but that same old straw to thresh over.

I would like, so far as Mr. Davies is concerned, this year, to have him get the benefit of any suggestions that might better the commercial work. We ought to go forward, instead of standing still.

The Chairman: Regarding the suggestion made by Mr. Hanlan concerning the contribution made by the Commercial Section to the General Sessions by Mr. Young, pleading for a more proper recognition of the Commercial Section and its sales activities, as backed up very ably by Mr. Gadsden this morning in the General Session. I do think we ought to listen to one of the recommendations made by Mr. Young—listen to them all, in fact, but take action on one particularly at this time, and I will be very glad to have someone make a motion to recommend to the incoming administration of the Commercial Section that they consider the formation of a Commercial Policy Committee.

(Motion duly made and seconded and carried.)

FINAL ADJOURNMENT

MINUTES OF THE INDUSTRIAL GAS SECTION

FIRST SESSION

Wednesday Afternoon, October 17, 1923

The first session of the Industrial Gas Section was called to order by the Chairman, Mr. R. M. Searle, the attendance being approximately 130 members and guests.

(During the reading of the Chairman's address, Mr. E. J. Stephany, Vice-Chairman, assumed the chair.)

ADDRESS OF THE CHAIRMAN

R. M. Searle, Rochester, N. Y.

I see by the program that I am slated for some opening remarks. I do not think that any gas man of long standing could have been more inspired than I was today by the exhibition on the Steel Pier; by the inspiration and by the possibilities shown there for the future benefit of everybody in the art; by the money spent; by the absolute confidence for the future those manufacturers must have in the art, expressing more by the money they have spent in that confidence than many gas men have expressed heretofore.

Having been in the gas and electric business now for forty years, I have had an opportunity to compare the two lines of endeavor and to make a study of the evolutions of both. I can recall in 1908, at Lake Champlain, a discussion as to why the automobile could never take its place in the social fabric of the country, because you could ride in a trolley for a nickel. I took the other side of that discussion and pointed out of the window to a sign, a big blue sign—I can recall it now—which read:

"BOARD AND LODGING $5.00
PER WEEK"

and yet we were paying $15.00 apiece at the hotel and none of us went to the $5.00 boarding house.

It is the right, the promise, the reward offered us by the framers of the Constitution—the pursuit of happiness. There has never been, and probably never will be, a bigger contribution than gas toward the elimination of drudgery to everybody and every class—a contribution to that happiness that the Constitutional writers and originators forecast.

I foresee now, from my experience in the electric business, that there is no limit to the gas business. It is a survival of the fittest and it is a survival

of the elimination of drudgery. It is the greatest comfort giver and will take its place in society because of its economic use, as the automobile has taken its place.

For four years, in connection with the trolley business, with a white pass in my pocket, I never was on a trolley car and I used the automobile at a dollar a throw for a ride, and there are tens of thousands—some twelve millions in this country—doing that today. I can recall when we could not give away a gas range or water heater. Baths were taken Saturday night, and if you smelled sweet, you skipped. Today there are three or four bathrooms in every house, a bath is taken every day, and sometimes oftener, and the carrying charge for the bathroom is more than the combined cost of taxes, water, interest and gas—forty years ago—for a similar living condition. All created by the opportunity; all created because inventive genius made the bathroom a necessity.

I have already stated publicly and reiterate here, in reply to Mr. Babson (and to give him due credit I understand he has since retracted the statement) that the gas business in Rochester in 1940 will be larger and more profitable than the electric business.

Let me show you how the electric man has to take advantage of the possibilities. Every catalog carries a direct connected motor, or every device shows a direct connected motor. Anyone can sell you a security if it has the word "electric" in it. Oil securities are more easily sold if you tell the people they are drilling the wells with electricity. That halo has been propaganded into the people until they have been saturated. But the demand is for that great state of the art of eliminating drudgery. Every magazine and every catalog features a gas range in the kitchen; linoleum ads, kitchen furniture ads show a gas range in the kitchen—many today are showing water heaters in the kitchen, showing by their salesmanship a kitchen is not complete, or a house is not complete, without this equipment. The same thing will take place in household heating.

Last April a man telephoned me and asked if he could have 3,000 k.w. of capacity by November 1st. He was promptly answered, "Yes." It required $600,000 of the Rochester Gas & Electric Corporation's money to prepare to give him that service. One customer! That is more than the capital of some gas gas companies, and we never dreamed of not doing it. We had a franchise and a monopoly and we felt we must give him that service. He has been taught that there is no other type of service to be used, and we are teaching that there will be no other type of heating that will be used but gas. The industrial plant will want millions of feet of gas per month and it will require hundreds of thousands of dollars to give it to them. Why not? If we know our art is the survival of the fittest—and no one knows it better than we do—and we have the imagination and the zeal and give the service, we are bound to get the business.

See what people are contributing to us? The zeal of the bathtub people. Plumbing appliances have brought more use for water heating. The zeal of men to make the kitchen attractive. And to sell their products, they sell and are featuring our product. The zeal of intelligent furnace construction will be so featured by those manufacturers that they will sell our product and create a de-

mand and if you will look today industrially on every industrial function supplying heat, gas has its place and a preference.

Like the village souse who stood on the curb as the funeral cortege went along, everyone in the village wondering what was going to happen next. He followed the cortege and when the body was lowered and the minister said,

> "Ashes to ashes, dust to dust,
> May his soul rest ever in peace."

the souse said, "What could be prettier than that?"

REPORT OF THE NOMINATING COMMITTEE

The Secretary presented the following report of the Nominating Committee: For Chairman, H. H. Clark, Chicago, Ill.; For Vice-Chairman, H. O. Loebell, New York, N. Y.

(Upon motion duly seconded and carried, the report of the Nominating Committee was accepted and the Secretary, as instructed, thereupon cast one unanimous ballot for the election of the officers as nominated.)

On invitation of the chairman they responded as follows:

H. H. Clark (Chicago, Ill.): The most encouraging sign I can see is the standing room only. That is very encouraging because a new section, which is more or less in the way of an experiment, is an undertaking. But when you see such an interest as we have this afternoon, it is assured of success.

First, I want to thank you gentlemen for the honor you have bestowed upon me in electing me chairman of this section and I hope that I will have your support to make the section a success.

The thought of this section was not mine—it was Mr. Cauley's, and I think he would join me in expressing gratitude for such a large showing as we have today.

H. O. Loebell (New York, N. Y.): I want to thank you gentlemen for having appointed me as vice-chairman. I believe that the growth of this section is going to be somewhat in proportion to the activities that we show this next year and I hope that every man connected with the industrial gas business will put forth his best efforts this year. I think on the momentum we gain we shall keep on going.

It is not news to any of you that this section has been opposed from its inception and its formation has been criticized. We have the responsibility to show that we know what we are trying to do and that the man who opposes it does not. I want to assure you that I will do my utmost to make this section a great success.

The Chairman: I will call on Mr. Sellman to please say a few words on the booklets that are to be reported on.

N. T. Sellman (New York, N. Y.): The former Industrial Committee early in the year decided it would be doing a useful year's work if it got together reference books on some of the more important industrial applications. Those

books were to be absolutely the last word in what the industrial gas men could get together, to be used as reference books in how to plan installations, and with loose sheets in the back giving the catalogue data of the various manufacturers who made appliances of interest to that particular subject.

The subjects undertaken were:

Wholesale Baking.
Steam Boilers.
Combustion.
Hotel and Restaurant Uses.
House Heating.
Large Volume Water Heating.
1000 Uses for Gas.

The data for these books on gas applications have all been sent in by the several committees.

The material as it was received from the committees lacked uniformity; in some cases it was not complete enough. Also, the committees were using illustrations and catalogue information that should not go into the text and probably should have gone into the end of the book. We found it would be a larger undertaking than anticipated and that it would be impossible to get the books out in time for this convention. Rather than make half a job of it we wanted to fill in the missing material and we decided it would be necessary to actually employ a man for this work. To be quite frank with you, I think it will take at least six months to edit the material we have collected to date.

In order to get a man for this work it was necessary that we get authorization from the Executive Board and that authorization was received at the last Executive Board meeting. There is nothing standing in our way now and I hope that all the books will be ready six months from date.

The books will be published in the standard letter size—8½″ x 11″—to fit in the ordinary loose-leaf binder. We estimate the average selling price of the seven booklets will be $1 each, this price to cover cost.

The Chairman: Before calling on Mr. Henry, I would like to say something in connection with the work on these booklets. You see the tremendous task assigned to the chairman next year and what it means in gross revenue. You can see the necessity for funds to do this work and do it efficiently. I am pleased to see our Association has come to that point where executives are ready to finance these things in the manner they should be financed. Speaking for the Rochester company, we are perfectly willing to substantially contribute because we could not begin to get what you will get in the next six months from this committee. It would require at least two skilled men on the job in Rochester and that would mean at least $5,000. If we took them from other work, it might mean $10,000, and besides, we have not got them trained and if we spent money to train them that money would not be spent economically to the advantage of the art. It should be contributed to the Association so that the whole art gets it, so that we may get that initiative that goes with concentrated, digestive work and effort of this kind. And with that in mind I would like to say to the incoming committee that the responsibilities of the whole business have been saddled on them, and they should have the funds.

Some of you may recall the speech I made for an Association laboratory, and I have never given up that thought. I made a speech at Troy in which I said I was always glad to pay the General

Electric a little more for apparatus, a penny apiece on lamps or $1,000 on a generator, for it went into the laboratory to give me a better lamp and apparatus on the next order. That is how I feel about this committe. Any money we put in, we put into our laboratory.

This industry has reached the point where large companies, facing such tremendous prosperity as the art offers, can well afford to develop a central point so we will get rapid evolution and enjoy the fruits of our effort and give to the public the service they have the right to expect by such intelligent use of the money.

It is the purpose in asking Mr. Henry, Industrial Fuel Engineer of the Combustion Utilities Corporation, to so dwell on the subject of "Wholesale Baking" as to start a fight, and broad discussion.

REPORT OF THE COMMITTEE ON WHOLESALE BAKING

H. M. Henry, Pittsburgh, Pa.

The development of the wholesale baking load has been seriously handicapped by the lack of reliable information on the best methods to use in applying gas to different type ovens and because very little data have been available as to the results which can be expected, not only in the application of gas to solid fuel fired ovens, but in correctly designed gas-fired ovens as well. Some of you no doubt have known for some time that gas has been successfully applied to nearly every conceivable type of oven, even to electrically designed bake ovens. Still, due to the fact that you did not know the manner of applying gas successfully to these different ovens, or because you did not have the least idea of the amount of gas required for 100 pounds of bread baked, you did not go after the baking load in your territory.

It was to fill this long-felt need that the Industrial Fuel Committee decided to publish a booklet, giving the different methods of converting ovens to gas, as well as the operating results obtained.

In the preparation of this booklet we tried to place ourselves in the position of the gas man who had never made an installation of gas to any type of bake oven. In doing this we decided that the following information would be of service in not only selling gas to the baking industry but in aiding the gas man to select the best type of installation to make.

The kind of data decided on was worked up in the form of a questionnaire and mailed out to a number of gas companies to be filled in. The questionnaire was as follows:

Kind of oven ....
Size—Baking chamber Width .... Depth ....
Special features ....
Baking temperatures—Maximum .... Minimum ....
Kind of gas supplied .... B.t.u. cu. ft. ....
Gas pressure at burner .... Inches H_2O ....
Kind of burners used ....
Special feature of burners ....
Manufactured by ....
Number used per oven .... Where located ....
Method of firing .... No. of shifts ....
Gas consumption per hour (average) ....
Standard conditions ....
Gas consumed per day—oven ....

Pounds bread baked daily ....
Monthly figures—
Gas consumption ....
Pounds bread baked ....
Rate at which gas is sold ....

Operation on Coke, Coal or other Fuel

Grade fuel used ....B.t.u./lb. ....
Tons fired per month ....
Pounds of bread baked per month ....
Fireman cost per month ....Hauling ashes ......
Repair to grate bars, etc. ....
Value of fuel handling equipment ....
Maintenance on above ....
Additional painting charges ....
Gas company name ....Location ....
Installation made at ....Date ....
Total number of ovens connected in plant ....

In addition to the blank questionnaire we also mailed a representative questionnaire filled out and had typed on the back of this a detailed description of any special features which we thought might be of assistance in making the data of even greater value to the gas man.

While undoubtedly there are some of you present who will not agree that data on the amount of fuel used per pound of bread baked are of any real value, yet the Committee on Wholesale Baking was at a loss to find a more suitable means of making comparisons. We feel, that in view of the fact that we have given in our data on typical installations not only fuel consumption per pound of bread baked but also the size of oven and the hours of baking, that with the exercise of a reasonable amount of common sense, the probable fuel consumption for similar ovens and baking conditions can be estimated, something the industrial fuel engineer could not do unless he had the data of a similar character with which to make his comparisons.

Questionnaires were mailed to about forty different gas companies, and while we received replies from a number of these stating that they would be glad to mail data, yet we received data from only one. You can appreciate from this the difficulties your committee had in obtaining sufficient data from which to draw conclusions regarding the different methods of applying gas to bake ovens of the same type, so that we could recommend a particular method for applying gas to give the best results.

In addition to mailing questionnaires to the different gas companies, we also mailed questionnaires to the appliance manufacturers, and we are glad to state that in nearly every case we received data and cuts of the installations made.

From the replies we received from the gas companies it was evident that there is a lack of appreciation of reliable test data, since in a number of cases the replies stated that gas had been applied to a number of installations but the test data taken were not in a useable form or else no data had been taken. It seems to us that if the different gas companies would realize that any installation of gas, however trivial to them, may be of

importance to some other company, we would have little difficulty in obtaining some real data for the gas fraternity. As an illustration of the importance of exchanging ideas this may be given—

In one of the western gas companies a certain concern decided to use gas in an enameling oven, temperature of operation being around 600° F.; gas was installed and the installation failed to give satisfaction. The failure of the gas company to make this installation a complete success not only resulted in the loss of this very desirable load to this particular gas company but lost this same type of load for another company in another city where the same concern built a new plant. There are no doubt a number of men present here who could have given the necessary information to make this installation a success. Yet because this information was not available to this particular gas company, two gas companies lost a good gas load. If we will bear this illustration in mind we will never make an installation of gas without obtaining all the test data possible and writing it up so that it will be of value to someone else.

In some of the replies received there seemed to be a difference of opinion regarding the advisability of converting existing coal- or coke-fired ovens to gas. Your committee believes that whether existing coal- or coke-fired ovens should be converted to gas depends entirely on local conditions. Thus, if you find, after a complete analysis of the prospective customer's conditions, that you cannot give him complete satisfaction in his baking results at a reasonable cost, by converting his present ovens to gas, and are reasonably sure that you can reduce his fuel cost to such an extent as to warrant the installation of correctly designed gas-fired ovens, then it is manifestly your duty to sell him an oven or to recommend one for his requirements.

In defense of those who have converted coal- and coke-fired ovens to gas, it might be stated that we have found the gas consumption in converted ovens to be very little different from that in correctly designed gas-fired ovens. So we would advise going slow on promiscuously recommending gas-fired ovens for all conditions. We want to point out that we make the above statement when fuel consumption only is a consideration. If your prospective customer is crowded for space and wants to enlarge his business, then it is possible for him to install a gas-fired oven and bake the same amount of bread in from a half to one-eighth the original floor space, to say nothing of a reduction in the number of men for the same capacity. It is on these items that the gas oven must be sold rather than on a reduction in the fuel consumption. It will certainly be of interest to have the different views of those present regarding the application of gas to coal- or coke-fired ovens, and we trust some of you will express your ideas regarding this.

You might be interested in knowing of some of the questions asked your Service Engineer, Mr. Sellman, and of one in particular, which the Committee on Wholesale Baking was instrumental in clearing up.

One of the heads of the Bakers Association wrote to Mr. Sellman requesting that he clear up a number of points regarding the application of gas to the baking of bread, pastries, etc. One of the questions asked was—What effect, if any, will the products of combustion of producer gas, city gas, and natural

gas, have on goods baked in direct contact with the products of combustion?

It so happened that the Committee on Wholesale Baking was able to clear up this point, with but one exception, that being the allowable percentage of sulphur in the gas without harmful effects. The answer to the question was given by analyzing the chemistry of bread making, and was as follows—

All of the bread produced today, with but few exceptions, is a light bread. The lightness is produced by the addition of some kind of dough-raising substance such as baking soda, yeast, carbon dioxide, air, water vapor, etc. Nearly all of the baking sodas when heated give off carbon dioxide gas and water vapor. These gases are trapped in the bread and when heated expand giving rise to the bread and forming holes, which accounts for its lightness. It is evident since the products of complete combustion of all gases consist of carbon dioxide, water vapor, nitrogen and a small amount of sulphur dioxide, and since all of these gases with the exception of sulphur dioxide are a necessary part of bread making, that they could not produce any harmful effect but quite the reverse. We do not know the allowable percentage of sulphur without harmful effects, yet this can undoubtedly be obtained with the cooperation of those companies who have gas ovens in operation. It is suggested here that the future committee obtain from the different gas companies having gas-fired ovens on their lines, the amount of sulphur per 1000 cubic feet and in this way some idea of the maximum permissible amount of sulphur per 1000 cubic feet, as now supplied for baking purposes without harmful effects, can be obtained. It might also be advisable to go even further than this and determine the definite percentage of sulphur at which harmful effects would result.

In this way we can save ourselves any possible damaging effects resulting from a gas company applying gas to a baking installation when the sulphur content present in the gas they are distributing is beyond the maximum permissible.

We would also suggest that the future committee draw up a data sheet form showing what information it considers important enough for the gas company to spend money and time in obtaining and to point out the advisability of securing these data under different methods of firing.

Thus, in view of the increasing popularity of the demand charge, it is necessary that we know the best method of firing ovens to produce the minimum cost per unit of output. By method of firing is meant intermittent or continuous. We know the demand will be greatest when firing is intermittent, and likewise the demand charge will be greatest, while in continuous firing the demand will be a minimum although the total gas consumption per unit of baked goods may be greater. If we knew the relation between the fuel consumptions with the two methods of firing, we could determine the most economical firing rate. Our company has started tests to secure this information several times but due to the rush of other business has had to discontinue the tests before reliable data were obtained. We still have hopes of obtaining this information, yet we would like some of the other companies to make the same kind of tests so that the results will be representative of the best practice.

This booklet is to be divided into three major parts—First, the subject of baking in general, giving the main

points of interest on the making of bread, showing why this is of interest to the industrial fuel engineer, and a brief discussion of different types of ovens used since prehistoric days.

Second—Method used in the application of gas to different types of ovens, together with test data on the different types, complete information on the conversion of ovens and a general discussion of the most efficient method of making the conversions where this was possible—all illustrated with cuts, pictures, and blueprints.

Third—Description by each manufacturer of his own particular make of oven, giving operating data and other data of interest to the gas fraternity.

While it was the intention of the committee to have complete operating data on every conceivable style of oven with gas as the fuel, so that the industrial fuel engineer could work up the probable fuel consumption for a prospective customer by using the data obtained on similar ovens, due to the lack of an appreciation of the importance of data of this character by gas companies, it was impossible to obtain the data required. However, we believe the data given are sufficient for the industrial fuel engineer to form some idea of what the fuel consumption will be, something he could not do unless data of the type given were available to him. The booklet is a start in the right direction and with a better appreciation of the value of reliable test data by gas companies, on installations of gas, no matter what the application, the forthcoming year should show a most valuable addition of data to that already obtained.

DISCUSSION

C. C. Krausse (Baltimore, Md.): I do not think that in general it is good policy to convert coal-fired ovens over to the use of gas without rebuilding. If it happens to be a direct fired coal oven, then it is all right to convert to gas, but if it is an indirect coal-fired oven, unless you rebuild the oven, in the majority of cases, the fuel consumption will be away out of reason.

N. T. Sellman (New York, N. Y.): I have converted the Peterson oven. The fire box is down below and the hot gases travel first to the back, then forward, and then to the back again on different elevations—three travels all together. I converted these ovens by cleaning out the tubes perfectly, so that there were no ashes left in them, putting spiral baffles through the tubes, cutting down the volume of the fire box as much as possible and then applying the gas in the old coal fire box through a brick channel. We then got a complete gas travel or enough so that the entire fire box at the very rear got red hot. In that installation we have comparative fuel costs that are fully equal to a direct-fired oven. In the indirect oven—that is, the usual one where you have brick flues—it is practically impossible to clean them out and if you have nothing in there to retard the gas travel it is not so successful.

Two of these Peterson ovens have double fire boxes and we put the consumption at about 550 cubic feet per hour in each fire box. The floor space required for the larger ovens is fully 14′ x 16.′ Two large ovens are used for bread, two smaller ones for cake. The installation is in the Hotel Pennsylvania, New York.

C. E. Muehlberg (Denver, Col.): I have converted a Peterson oven and I was very well pleased with the results. It was the best I found on the old type brick oven. I also converted two Durkop ovens and I would say offhand the increase in consumption was possibly 10% or 15% over the Peterson oven. In another bakery we have made a complete conversion from coke to gas on three Helm ovens. We thought we were going to have a good deal of trouble on the job because the oven was a two-story one—that is, the fire box was in the basement and the baking was done on the second floor. They had to heat up an enormous fire box. We did away with that by closing off the fire box and installing our burner equipment on the baking floor. We found on that oven that we had about the same economy as we had on the Peterson oven.

We are serving a gas in Denver which is a little different from that found in the rest of the country. We carry a lower calorific value than most of you are acquainted with. And that makes me offer a suggestion. Instead of giving the consumption of any industrial plant in cubic feet, give it in B.t.u.'s because most of the ratings are given that way. We are all getting away from the 600 B.t.u., going to 550, 535, 500 and still lower than that—to 330 on the direct-fired oven, serving on a three-part rate. We were able to heat the oven very nicely, and because of the excessive demands required, it makes the serving of the gas on a three-part rate a little more profitable. On the direct-fired oven our costs, compared to sub-bituminous coal, are about twice that of coal.

In one case—in fact in all cases in the very large bakeries—you are able to meet the difference between coal costs and gas costs by adding on tangible and intangible items that we put a dollar and cents value to. Sometimes it is hard to find a tangible one, but we, being gas men, will appreciate the intangible ones, although it is mighty hard to convince a plant manager that the intangible ones are there until he has made a trial. I think until we have a strong enough foothold in the baking business we will not be able to convince them that the increased cost is worth all they will pay for it. But it will come.

J. B. Allington (Rochester, N. Y.): I would like to inject one thought at this point. It is impossible to compare gases of different calorific value on a B.t.u. basis unless you also take into consideration the volume of air necessary to give complete combustion, and right there is an obstacle we are going to meet from now on in the ratings of various appliances. I would suggest that some research work be done in order to give us accurate data for comparison of gas consumption on appliances with gases of different calorific values.

T. B. J. Merkt (Brooklyn, N. Y.): The government has issued a bulletin recently with those points in view, comparing different calorific values of gases.

The Chairman: The Bureau of Standards has done considerable work on that. The plot for a clearing house thickens. You can see right here the necessity for economic research so we can go to a customer with that zeal and knowledge of our art and can say "yes" or "no" snappy like, right off the reel, and sell him something. But the experimenting with his equipment and interference with his baking are more or less disturbing to a prospect. The electric man comes along and says that he

will put in equipment for so much money and it will do the work. That is what we have to have in our business and we are a little bit shy, as is being illustrated right here among the "know" of the art—they admit they "don't know." Paradoxical as it may seem, it is a fact, for they have not the time, they have not the equipment. So I want to emphasize again the necessity for a research laboratory, turning the findings into the common pot for the common good of those in the industry. After hearing the splendid talks in the General Sessions you will see that competition will compel you to set up such a laboratory. We cannot go on exploiting the customer with our ignorance.

E. Stephenson, Jr. (Danbury, Conn.): Last June I went to the electric convention to see what the electric man had in industrial art and they certainly disseminate information; they have it all at their finger tips. If we want to keep up with them we have to have information.

One thing that has not been mentioned is the fact that in converting brick ovens it is necessary to put in a great number of checker brick to reduce the space. I find in the ovens we have converted we have had to fill up the combustion space with fire brick until we got down to a certain area. I think it would be wise to find out the cubic feet of combustion space, because that will be important.

R. L. Manier (Syracuse, N. Y.): A question that it might be well to bring up is whether it would be well to spend any energy in the smaller bake ovens or confine ourselves to the wholesale bakeries whom we believe really will be ultimately the bread bakers? We understand in one particular instance four ovens of the continuous type were able to supply enough bread for an entire city of 130,000 population. I believe if that condition becomes general the small baker will not be able to compete with the continuous type ovens and the flash heat ovens.

In Syracuse we have a case where bread is being delivered to the door the same as milk. If that is started in many cities, I am afraid the little fellows will be put out of business and we should have data at hand to catch the others before the coal man beats us. The installation in Syracuse, unfortunately, is coal ovens. I think it might be well for us to decide whether we want to put our energy forth for the small fellows or for the big fellows and catch them while they are turning over.

C. C. Krausse (Baltimore, Md.): In Baltimore we have a population of around three-quarters of a million people. We have four large bakeries. Most of those are using gas for either all their baking or partially. But in face of all that, the bakers with traveling ovens putting out 3,000 loaves of bread per hour, about 40% of the business is still in the hands of the small corner store or semi-wholesale business. I think we still have to devote our attention to trying to get some of the smaller business.

A. A. Schuetz (Milwaukee, Wis.): Milwaukee has about half a million population, with four large bakeries and about 300 or more of the so-called peel-type brick ovens. I think you are all familiar with their operation. Out of those 300 ovens we have about 190 converted to gas. We have not noticed any material decrease in our gas sales to these ovens. Our condition may be somewhat unusual. I do not know what proportion of that is with what you call the neighborhood bakers. We have

accomplished these conversions by using a fan-blast burner which swings into the ordinary door when the gas is to be used and a nozzle which can be arranged so as to sweep over the entire hearth. The fuel consumption on an oven of that type will average about 30,000 cubic feet a month and the equivalent baking would require about two cords of wood.

J. A. Sutton (Philadelphia, Pa.): We are not in the gas industry but closely connected with the industry and I might state that during the last year the people who manufacture the largest and most expensive gas traveling oven have put in over 150 installations. Their opinion is that although it costs more with gas, people who have coal ovens are buying more gas ovens all the time and buying more big gas ovens. I think that might have some bearing on the subject of the wholesale trade.

J. F. Quinn (Brooklyn, N. Y.): We in Brooklyn have several of the Baker-Perkins ovens and I know the consumption is running around .8 of a cubic foot of gas per pound of dough baked. We have a population of over two million people, with two thousand or more bakeries—that is, local bakeries, and they are not going out of business. The Bakers' Association is as big in Brooklyn as ever. I think the experimental work should go along on the smaller lines as well as the larger lines.

N. T. Sellman (New York, N. Y.): We started this meeting to have some arguments. As long as the Baker-Perkins oven has been mentioned, I will say that I think it is a wonderful oven and a great gas consumer, and I think the Baker-Perkins Co. deserves a lot of credit for what they have done. I know they still claim that they have practically no cooperation at all from the gas companies. Somehow or other they have not got together on selling the oven —perhaps the discounts have not been right—but any gas man can certainly be proud to have a Baker-Perkins oven on his line.

H. B. Holman (St. Louis, Mo.): I wish to say for the Baker-Perkins people that at no time have they ever asked the gas companies to work with them on their sales. They prefer to make the sales direct themselves. We have two in our city and they are using considerable gas.

A. A. Schuetz (Milwaukee, Wis.): I believe the smaller baker should be given due consideration. We have one Baker-Perkins oven installed now, Atlantic & Pacific, but inquiries show they are also figuring on the trade of all the neighborhood towns in a good measure. They think their loaf of bread is an inducement to bring people into their stores. I do not think that will materially affect the neighborhood bakers for some time. For one reason the bakers, such as we have, are not confining themselves to bread or rolls but are going into all the different classes of baking.

J. A. Sutton (Philadelphia, Pa.): So that I may be perfectly understood on this matter, I do not represent the Baker-Perkins people. I represent a combustion system entirely.

O. L. Maddux (Kingston, N. Y.): Practically all of the discussion on the type of bake ovens has been confined to those of the larger cities. The smaller gas companies are getting the idea now that they have to establish wholesale rates and get industrial business in order to build up along their lines. Practically all of those cities have fairly good sized bakeries but yet not large

enough to have traveling ovens. The application there is similar to what you have in the larger cities in the neighborhood bakeries. There is going to be a necessity with these companies to have data available on the different types of coal- and coke-fired ovens, and for that reason I think it would be advisable to get such data for the smaller ovens and keep it because they are going to stay there for quite a good many years.

A. A. Schuetz (Milwaukee, Wis.): Those bakeries with the small ovens—8′ x 10′ or 10′ x 12′—are all baking during the night, off peak. That is pretty much a local thing.

J. F. Quinn (Brooklyn, N. Y.): In getting these data it will be absolutely necessary to take into consideration all of the different kinds of bread baked. Different nationalities have different methods of baking bread. Another thing that this committee does not want to sidetrack is the amount of steam available in each oven. That is something that cannot be gotten from any engineer in the country—the amount of steam that is used or necessary per oven.

J. W. Smith (Indianapolis, Ind.): We have several traveling ovens in Indianapolis and we have a good many of the smaller neighborhood ovens. I have found that the smaller bakeries are fast getting out of the baking of bread and are devoting their energies to the baking of confections, cakes, etc. It would appear from our experience that the future baking of bread will lie with the big bakeries and the baking of confections will be handled in the smaller bakeries. Therefore, the small bakeries are still going to be with us and their business will be valuable.

I would like to inquire if any test material or information is available in regard to the application of the various types of ovens—direct heat vs. radiant, etc.

N. T. Sellman (New York, N. Y.): The only thing I can say is this—In converting direct-fired ovens, that is where the fire is going to be right in the baking chamber, I have personally found radiant heat is quite important. As a matter of fact, the only way you can figure your heat distribution or the guide we use for figuring heat distribution is to get the hearth uniformly illuminated and if you have a good uniform light effect you get a uniform heat distribution.

J. W. Smith (Indianapolis, Ind.): What I had reference to was the newer type of ovens, such as the Baker-Perkins, which are endeavoring to produce a radiant heat. I think they have had some trouble in producing that radiant heat in the oven. Ovens constructed in the past have been based on developing a radiant heat and transmitting that to the bread to be baked. We can transmit to the bread to be baked much faster by direct heat. Would it not be much better to use direct heat in the traveling ovens than trying to transform it into a radiant heat?

The Chairman: I would like an expression of opinion from some members of the section as to whether or not they are relying on direct heat.

J. F. Quinn (Brooklyn, N. Y.): I do not think in the Baker-Perkins oven they are relying on radiant heat, those that I have seen. On the converted direct-fired ovens we rely on radiant heat but I do not think it is for bread as much as for pastry. If it is an oven to do heavy duty, one made largely of brick, containing a mass of material, practically all the baking is by radiant

heat. But in the smaller ovens, sheet iron ovens, etc., there you are baking largely by convected heat which would probably be the most economical. If you have a continuous oven you are baking by radiant heat to the greatest extent.

E. D. Milener (Baltimore, Md.): I would like an expression as to whether or not they have been able to successfully apply steam to direct-fired ovens. We have not met with much success as yet. I understand some have made tests and have been able to get very good results.

H. Behrman (Brooklyn, N. Y.): While we have not had much experience putting steam into gas-fired ovens, we have done quite a little business with small gas-fired boilers and coal-fired ovens. As Mr. Quinn said, there is a big difference in the bread baked by the different nationalities, and men will require different boilers to do practically the same work. It is more or less a cut and dried method. We have found the maximum demand as near as we could figure was 1 h.p. for 20 cubic feet of space in the oven for the old peel-type oven.

J. W. Smith (Indianapolis, Ind.): Regarding application of steam to the ovens, I have always understood that steam is used simply to produce a certain finish on bread. The trend today seems to be to disregard finish but get uniform product, and that is the reason so many traveling ovens are being installed around the country.

I asked particularly of Mr. Taggart of the Taggart Baking Company of Indianapolis, one of the largest bakers of the midwest, why they changed over from very efficient coke ovens to the traveling oven heated by gas when the cost of the baked bread was so very much higher with gas than with coke. He stated that the sole reason was that they had a uniform product, every loaf coming out exactly the same, which they did not get with any other type of oven.

H. E. G. Watson (Toronto, Can.): I was somewhat surprised to hear this question asked about using steam in the ovens, because we get back to the Baker-Perkins ovens again that have been so much talked about. In all the ovens they have installed in my city they use steam, and large quantities of it, and do not seem to have any particular difficulty except once in a while in the smaller ones it will smother a burner, but not very often. I could not give you any idea in horse power how much steam is used but it is enough so that the condensation which gathers around the burners, when they enter the oven, rusts them out and in one company they have had to renew in two years most of the burners.

I might also say that this same company has converted coal-fired traveling ovens to gas. Evidently they do not think there is much of a problem to that.

There is one other thing that I hate to see pass without having something to say about it and that is about the electrical men and what wonderful wizards they are. I have met a lot of them and so far as I can see they are no brighter than we are. They figure things out—so much horse power on a motor, which is as simple as A B C, as simple for them as it is for us to figure pipe sizes. But when they go to take measurements, etc., on equipping an oven with electric radiators they are as much in the dark as we are. So do not feel too discouraged about that.

E. D. Milener (Baltimore, Md.): I thoroughly agree with Mr. Watson that the electric men are no smarter or more intelligent than we are, but I think he missed my point regarding steam and ovens. I mean atmospheric ovens—a small atmospheric oven or a traveling atmospheric oven. We have never been able to apply steam successfully to that type of oven. I am well aware the Baker-Perkins people are successfully applying steam but the information I would like is entirely on atmospheric burners.

H. H. Draper (South Bend, Ind.): Is it not where the steam pressure is greater than the air pressure that it has a tendency to smother burners?

The large ovens, as the Baker-Perkins, are under pressure and it may work more successfully. At the same time, consider the ventilation in that oven.

J. B. Allington (Rochester, N. Y.): I think that all the steam that would be necessary in a bake oven should be atmospheric steam and if the atmospheric burners are properly designed as recommended by the Bureau of Standards, with that increased burner pressure you should have no trouble.

R. L. Manier (Syracuse, N. Y.): Looking at it from the gas production stand, we always purge a machine with steam so as to kill any chance of explosion there. I think that is really the action that occurs.

H. E. G. Watson (Toronto, Can.): I do not know that I ought to say anything about this, because it does not contain much information. But the same thing interested me and just the day before I left home I had one of the small portable ovens, the largest size the Wm. M. Crane Company make, connected to the steam boiler and a steam jet put into every shelf of the burners with atmospheric vent sufficiently large. We let that run all the afternoon with steam, 30 pounds pressure on the boiler, and so far as we could see, it did not interfere with the combustion of the burners at all.

REPORT OF THE COMMITTEE ON STEAM BOILERS

H. Vittinghoff, Boston, Mass.

(Presented by F. K. Simmons, Pawtucket, R. I.)

The booklet on Steam Boilers is still in preparation and unfortunately no part of it is in such shape that it could be presented here. But it is well under way and practically all of the data are collected and it is now a case of putting them together.

I would like to give just a brief resumé of what the book covers in order that you may make suggestions as to what changes in, or additions to, its contents should be attempted.

Part one of the booklet is devoted essentially to the underlying fundamentals of boiler operation and their application to gas-fired boilers. Feed water supply and points of importance to be considered in connection with this are covered. The importance of proper installation, not only of the boiler itself but of steam piping, is stressed and figures are quoted on efficiency of various forms of insulation, advisable thickness being stated.

Mention is made of the fact that the manufacturing department of the gas company is usually familiar with steam boiler operation and, though they may have had no experience with regard to gas-fired boilers, can often give much information on general steam principles. In any event, close contact between the industrial sales department and the manufacturing department is of paramount importance. Methods of installation are described briefly and principal points to be considered are raised.

The operation of the boiler is described, particular stress being laid on the fact that these boilers are usually operated by unskilled attendants. This is particularly true of low pressure boilers, as high pressure boilers in many states require licensed attendants.

Part two of the booklet describes the revenue-producing possibilities of the boiler and also covers in detail the question of necessary servicing. Various types and makes of boilers are described at length, and much data obtained from manufacturers are quoted. Necessary and superfluous accessories are referred to and their method of installation discussed. Various methods of calculation of boiler size and gas consumption for various jobs are detailed, and a number of valuable tables covering actual consumption are included.

So much for the booklet as it is. It appears to me that the purpose of this presentation or apology for failure to present the finished book is primarily to find out what we need and what should be included in the handbook, and in talking with regard to the booklet I hope to start discussion rather than to end it.

This booklet should meet two needs for data—First, it should give the salesman or the industrial fuel engineer all

information possible to enable him to make sales in as many varieties of instances as practical. Second, it must conclusively point out the value and importance of this class of business both as an independent revenue producer and as a possible entree for further industrial business development.

This last consideration gives rise to the question—Is this business of particular importance; should our salesmen concentrate on this appliance? Unqualifiedly yes. In the average industrial community the boiler constitutes an entering wedge of more general and apt application than probably any other form of industrial gas service.

Why? The answer is obvious. Industry has always required heat. Before gas and electric companies became awakened to the industrial heating development, steam furnished the easiest and most economical method of heat transmission and thus steam has been customarily applied in many processes where possibly direct heat would do better work. In small industries, such as prevail in the field of many gas companies, heat is required in relatively small quantities and can often be economically produced by the gas boiler. In large factories, in a great many cases, the needs for process heat are so great that the gas boiler is sometimes uneconomical, but in a great many instances the demand for steam is scattered and can be advantageously cared for by a number of gas boilers installed at or near the points of utilization. Also, there are many industries, such as numerous of the textile lines, where in very large factories heat or steam are required for only limited processes and in relatively small quantities.

In some sections the gas company has thoroughly covered the field. In these, the gas boiler must stand on its own merits as a desirable class of business to be sought. In others, the surface of industrial business has been but scratched. Here the gas boiler offers an excellent chance for introducing gas service in various industries requiring heat in quantity that can be advantageously supplied from other forms of industrial gas appliances.

The revenue derived from the operation of the boiler obviously depends upon its size and its use, but in general its load factor is good and the demand upon it continues through hours of factory operation.

This leaves us with a more difficult question. Just what information should be placed in the hands of the boiler salesmen? These are men of many varying degrees of ability and act under varying degrees of supervision. It therefore seems that to fill the need completely the booklet should be designed for the men having some general knowledge of the gas business but who are just entering the industrial sales field. These men must have information with regard to the fundamentals of boilers, in general, and also must be informed on the elements of gas combustion as applied in the boiler.

It would seem that a detailed description of various types of boilers in such a booklet is of questionable value. The purchaser is not apt to go wrong on any of the standard makes and it will probably be best to decide on one line and become thoroughly acquainted with it in all of its details. Specifications of various makes of boilers are constantly changing and information on these may be right today and in error tomorrow.

The installation and care of the boiler are simple matters and if the general

fundamentals of boiler operation are considered, these are not apt to go amiss. While many gas companies seem to successfully pursue the policy, once the boiler is installed and operating properly, of forgetting it entirely except to read the meter monthly, it is, without doubt, of great importance that such appliances, regardless of their size, should be placed upon a regular maintenance schedule.

It appears that the question of primary importance, rather than being an attempt at a complete compilation of the technical details of various boilers, is the relation of the boiler to the industry. What will it do? Where can it well be installed? What needs will it fill? Let us decide what the accomplishments of the boiler should be and then get a boiler to meet our needs.

The gas-fired boiler is very versatile in application, having a place of varying importance in practically every industry and in the majority of these must meet certain qualifications. It must burn its fuel economically, be compact in size, easy to operate, adapted to unskilled handling, free from undue fire hazard, flexible of control and 100% reliable in operation. Due to fluctuating demands liable to be placed upon it, the boiler should have as great a water capacity as is compatible with efficiency, and reasonable first cost. Most of these requirements are met by the majority of standard boilers and undoubtedy all of us quote these as advantages in attempting their sale.

A verbal enumeration of applications of the boiler is not possible in a short time. My own experience has been that it is possible to find a place for the boiler in practically every line of industry carried on in the territories in which we operate and probably this has been paralleled in the majority of the companies elsewhere.

This resumé has been of a general nature rather than a detailed citation of actual data or experience, and it is hoped that you gentlemen may start a little discussion which will throw light on more of the practical aspects of the subject.

DISCUSSION

J. F. Reynolds (New York, N. Y.): Your large word is "Service." While there are thousands of boilers sold by gas companies throughout the United States, you will find the greatest difficulty is in water feeding arrangements and automatic devices. I think a lot more attention should be paid to automatic controls and means of feeding water. The servicing of the boiler is the greatest obstacle we meet. We find after the boiler has been sold by the sales department that the real work starts after the installation is made, or it is about to be installed. That is, information is necessary to operate that boiler in the most efficient manner, and any information you men have in regard to automatic devices should be given to the committee to incorporate in the booklet.

O. A. Bowen (Chicago, Ill.): We have made it a practice in selling our gas-fired steam boilers not to leave the installation until some one in that plant is thoroughly acquainted with the full operation of that boiler, whether it be automatically water-fed or if there is an injector on it. If it is necessary for us to stay on the job a week or two weeks,

we do so. We have probably ten or twelve thousand boilers installed in the city of Chicago, representing probably 20,000 horse power, and the load is so great there that we feel we are repaid for the time and effort we spend in that plant in educating some one there to take care of and maintain that boiler. I dare-say we do not average over two complaints a month for readjusting burners, etc.

A. A. Schuetz (Milwaukee, Wis.): There is another point which I think might receive some consideration from the committee. The power plant fraternity is getting away rapidly from the horsepower classification. Consider a solid fuel generator—there is an opportunity there by increasing the temperature of the fuel bed to increase your rating. That is not always a practical application in a gas-fired unit. I think we should put some attention on the number of square feet that will be required in the differently designed generators.

N. T. Sellman (New York, N. Y.): There was a set of tentative specifications presented at the general session this morning, covering standard methods for testing and rating, both gas-fired, steam boilers and hot water boilers.

R. G. Munroe (Denver, Col.): I believe it might be well to give some consideration to the attitude of our city authorities towards the gas-fired boiler. In Denver they regard a low pressure boiler as one operating below 15 pounds. I believe that we should pay some attention to the advisability or the necessity of having the city authorities in all cases make regular inspections. It has been our policy in Denver to notify the city boiler inspector of each installation because we wish him to know of these installations and call on them once a year and be sure that they pay for and have a regular annual inspection. The Denver municipal definition of high pressure boilers, which must be operated only by a licensed engineer, is 15 pounds and 6 horsepower.

J. B. Allington (Rochester, N. Y.): I want to call attention to the possible field for the development of both the gas and electric load in the sale of high pressure steam boilers. That is a particularly attractive business to combination companies. In Rochester we have an electric rate so designed that a customer coming on for the summer months only, earns a very low rate. Now we find that we can go into a plant and by supplying them with the necessary steam in the summer, through a gas-fired boiler, get all of their electric load. That is worthy of consideration.

R. L. Manier (Syracuse, N. Y.): In Syracuse we have tried something that may be of interest, in regard to the psychological effect when the man opens a valve of a steam boiler and sees the gauge needle go down. No matter how big a boiler you have, when the valve is open that needle is going to go down. In every job we have, the nipple is tapped and a standard brass pipe plug is screwed into the nipple. This plug is drilled to the proper size hole for required steam passage of pressure desired. We know then that a workman in opening that valve, no matter how often he opens it, will see that the gauge will register as expected.

We always make it a point to explain to the general manager, or someone in charge, why we are doing that and we have had many thanks because of it. A workman opens the valve on a sponging machine, for instance, and if he sees

that gauge drop he immediately says that the boiler is no good and recommends throwing it out. But when you put that plug in, the situation is immediately cleared.

J. P. Leinroth (Newark, N. J.): Is that plug right in the line?

R. L. Manier (Syracuse, N. Y.): Just beyond your main outlet from the boiler. In a plating shop, for instance, the average man will go there and regardless of whether he has a ¾″ line the chances are, where there is a gas conversion, they will want to open every valve at the same time. The psychological effect of seeing that gauge drop is bad and it immediately makes the foreman and his men say that the boiler is no good and they want to kick it out. I had such a case on a sponging machine and I put the boiler plug in there, explaining to the general manager why I did it, and the sponger himself saw it going in and he thought we were trying to put something over on him. We explained that he could keep that going twenty-four hours a day if he pleased and every piece of cloth going through would have the same amount of steam, therefore the same shrinkage. Before we got through, every one in the organization came and personally thanked us.

J. P. Leinroth (Newark, N. J.): They have used that same thing in New Jersey except that they use a disk.

J. Zander (Chicago, Ill.): I cannot quite see how the arrangement of a plug is anything else but putting it over on a customer. In this case, as I understand it, you put a structure between the steam gauge and pipe line from which the customer is using steam. You make him believe that he is getting steam on a steam boiler, which is misleading. He is getting steam from pressure that would be truly and correctly indicated on the gauge, and he, in that case, would be educated to know what he is doing and understand under what condition he gets his steam. The disk stands in the way of giving him the proper knowledge of what he is doing.

N. T. Sellman (New York, N. Y.): I wish to check on that. There are a few installations where a plug like that might help the installation. In many cases the man thinks he wants pressure but he does not. It would never work on an installation where you wanted the gauge pressure to correspond with the pressure at the appliance. You have to get the pressure and it is not the gauge that counts—it is the actual pressure at the appliance.

E. G. de Coriolis (Boston, Mass.): As I understand it, this is a situation which exists in Massachusetts alone. Massachusetts has improved on this every year and, so far as I know, there is only one single gas-fired boiler which can be sold in Massachusetts. All others on the market do not meet the specifications and therefore cannot be sold. The one that does meet the specifications is an excellent boiler but we do not want to depend upon a single manufacturer for all the gas-fired boilers we need.

A commission in Massachusetts makes the rules and regulations and if manufacturers want to sell boilers there they have to meet them. Those specifications were drafted for coal-fired boilers and not gas-fired boilers and the point I raise is as to whether this Association wants to take any steps in connection with that matter.

W. A. Doering (Boston, Mass.): I think Mr. de Coriolis is in error. There are quite a number of lower pressure boilers, 15 lbs. or under, in Boston;

there are at least three high pressure—Kane, Russell, Roper. We have installed quite a number of Kane and Russell and they are all passed by the State and the city. They are high pressure, under ordinary conditions, 100 pounds.

J. W. Smith (Indianapolis, Ind.): I have been told by some boiler manufacturers that the state laws in Indiana, or the boiler code in Indiana, is even stronger than that of the state of Massachusetts. So far as we have been able to find out, there are only two boilers that will pass inspection in the state of Indiana, and one of those has been mentioned. In connection with these specifications of steam boilers, would it not be well to get in touch with the Committee of Specifications of the American Society of Mechanical Engineers? I understand they are now re-drafting specifications for small boilers.

N. T. Sellman (New York, N. Y.): I can assure you that we are following it very closely in our code. We recommend, so far as construction is concerned, that the A.S.M.E. Boiler Code be used. In fact, that is the boiler construction code we follow. The only thing we have really done that is important with gas is rating and testing so that if you test a boiler in Chicago, Denver or New York, you should get the same result. I know one boiler manufacturer who recently sent his boiler out to two or three laboratories and the results varied all the way from 2 horsepower to 600 horsepower on the same boiler.

R. G. Munroe (Denver, Col.): I believe the American Gas Association should institute an educational program with all municipal and other authorities to educate them to the fact that the same requirements concerning licensed engineers and firemen on coal-fired boilers should not be applied to gas and automatic boilers.

The Chairman: I think that is an excellent suggestion for the next year's work of the committee.

H. E. G. Watson (Toronto, Can.): So far as I know, all the gas-fired boilers on the market are fired with atmospheric burners. Right in line with what a gentleman said, a few moments ago, that the tendency with coal-fired boilers is to fire them far beyond their normal rating, more than two or three hundred per cent. It seems to me that it would be a useful thing for us to be able to do that with gas-fired boilers, and I would like to know if some of the members present here have had experience using either high pressure gas or gas burners. I do not doubt but that some of you have—probably Mr. Zander did that twenty-five years ago.

N. T. Sellman (New York, N. Y.): It has been tried but I would not say successfully. We have been using blast burners, either fan blast or positive pressure, with checker brick, but it comes back to converting, as a rule, an inefficient coal appliance and your final cost is high. You lose your automatic sales argument that you have on the properly designed gas boiler. It is so much harder to control any blower appliance than a straight atmospheric burner. If we could work out a control, then it might be feasible.

H. O. Loebell (New York, N. Y.): I believe the ratings of boilers are indefinite unless you mention all of the conditions. You can take a gas boiler and increase its rating, I daresay, 10 times. What you are going to do to the efficiency, I do not know, but your heat

transfer is a functional velocity in differential temperatures. The higher the temperature, the more velocity. If you have good circulation in the boiler, I do not care what the rating is, you can increase its ratings provided the materials will stand.

In the coal-fired boiler when the stoker was introduced they found it could go to higher temperature due to the fact the coal was moving and the clinkering was not formed. Now when they go to the power of coal or gas they will have still higher ratings due to the same factors, because the physical interferences are being removed.

I have not done any work with gas boilers but I believe the gas boiler today is due to be redesigned to get higher ratings. I think there is a good opportunity to decrease the investment in the gas-fired boilers and get better results.

H. H. Clark (Chicago, Ill.): I think a little misunderstanding has come up about the plug or orifice. I did not understand the gentleman to say that it was limiting the amount of steam which would be pulled from the boiler. Of course in that position you are not cheating anybody because, if you have a boiler of the proper size for the job, I do not think you would experience the trouble you speak of; but if the boiler is too small it would enable you to maintain a more level water control if you had an automatic feed.

In the case of heating plates, would not the plate eventually come up to the temperature corresponding to the steam pressure in the boiler? If your boiler is designed for the given condition, so long as there is direct intercourse between the boiler and the appliance would not that strike a balance?

R. L. Manier (Syracuse, N. Y.): Yes, I get your point.

J. Zander (Chicago, Ill.): A steam gauge shows 10 pounds of pressure; the temperature of that steam will be around 250°. The man looks at it and thinks he has 250°, whereas beyond the plug in his line he has only a pressure of atmospheric, or one or two pounds, and the real temperature of the steam applied to his work will be slightly over 225°, reading on the gauge 250°.

(At this point Mr. R. M. Searle turned over the Chair to Vice-Chairman E. J. Stephany, who acted as Chairman during the balance of the Section's program.)

REPORT OF THE COMMITTEE ON COMBUSTION

H. O. Loebell, New York, N. Y.

If I undertook to discuss the problem which has been assigned to me today I do not think that any of you would see your home town for another week. What I am going to give you is an idea of what we are trying to accomplish in the form of a booklet and what we are aiming at. By getting your suggestions we are going to be able to make that booklet better for you than we could otherwise.

The first draft of the book has been prepared and submitted to Association headquarters and the various members of the sub-committee. At the present time the work is in process of receiving and considering the various recommendations, criticisms, and suggestions of the different members of the sub-committee, preparatory to drawing up the final revision of the contents of this book.

The book is still in its preliminary form and the sub-committee is waiting for suggestions and thoughts from the different members of this entire section. This meeting gives us an opportunity for a complete exchange of ideas so that when the book is written it will represent the consensus of opinion of the entire personnel of the Industrial Gas Section.

The sub-committee in preparing the book on combustion had to contend with a problem which is not quite so much in evidence in the preparation of the other books, due to the fact that the material on the subject of combustion is practically unlimited. Therefore it has been up to the committee to decide just what subjects were the most important and what should be included in the treatise. Of course doing this and at the same time preparing a book which is not too large in size or too comprehensive for the sub-committee to undertake, means that only a comparatively small portion of the general subject of combustion can be discussed.

The book as submitted in its preliminary form amounts to some ninety typewritten pages, and the sub-committee feels that it is not advisable to add very much more to this particular treatise. As it is, the information embodied has taken an enormous amount of time and energy to compile, and it appears that if the work undertaken is too comprehensive in scope it would never be arranged in final form for publication.

If we aim at too big a goal, we shall never realize our objective. The sub-committee feels that rather than try to collect all the information on combustion and publish it in one volume, it is better for us to select the most important information and get it into the hands of the gas man in the very near future, and, at some later date, publish supplements to this book which will contain other important information which we feel should be circulated.

The treatise on combustion as prepared consists of some nine chapters.

The first chapter deals with the definition of those technical names, terms and units which are constantly used in all subjects pertaining to combustion. An attempt has been made to give these definitions in a form which would be accurate from a scientific standpoint and at the same time be sufficiently non-technical as to be readily understood by the layman.

Chapter two involves a discussion of the physical conditions which affect the volume of gas. Since gas changes in volume under varying temperature and pressure conditions, a cubic foot of gas means nothing unless the physical conditions, i.e., temperature and pressure, are prescribed. The gas man, in figuring out problems and making calculations, must at all times know the temperature and pressure conditions under which the gas is being measured and he must be in a position to be able to calculate how the volumes of gas will be affected by changes in the temperature and pressure conditions. At the end of the chapter, a set of correction tables are embodied which give correction factors for calculating the changes in volume of gas under various barometric and temperature conditions.

Chapter three is one of the most important discussions in the book and deals with the "Chemistry of Combustion." Symbols and molecular weights of chemical compounds generally used in calculations by the gas engineer are given. Methods of calculating the amount of air required for the combustion of a fuel are presented in a clear and non-technical manner. A discussion of the reactions that take place in the combustion of any fuel and the manner and methods of calculating the amount of the different products of combustion are described at length.

At the end of the chapter a chart is embodied which gives in rather complete form the important characteristics and combustion data of our most important commercial fuels. This chart includes the analysis of the gas, the specific gravity, air necessary per cubic foot of gas, net and gross B.t.u. value, volume and composition of the products of combustion, ultimate CO_2, net B.t.u. per cubic foot of air-gas mixture, net B.t.u. per cubic foot of the products of combustion and the theoretical flame temperature.

Chapter four deals with the important subject of "Calorimetry." A brief survey is given of the different methods of calculating heat values of fuels with a detailed description of that type of calorimeter which is generally used in our industry. As a check to calorimetry measurements, methods and means are given to calculate the heating values of fuels from their analysis. A table is embodied which gives complete data regarding the molecular weights, specific gravities, and heats of combustion of our different combustible gases.

The subject of "Thermal Capacity" or "Specific Heat" is discussed in chapter five. Consideration is given to the definition of terms, and the calculation of mean specific heats, involving solids, liquids and gases. Latent heat is defined, followed by a discussion of the changes produced and the latent heats involved in condensation, vaporization, and fusion of different substances. Charts are embodied giving thermal capacities under different temperature conditions of our various gases and important commercial metals and alloys. Data are also embodied which give complete information on the mean specific heats of the different gases and substances used in combustion engineering work.

Chapter six deals with the very important subject of "Flame Temperature." The methods of calculation presented have been worked out very carefully and represent—so far as we know—the latest knowledge and best experience on this subject. The theoretical flame temperatures determined for the different gases are somewhat lower than those which have been generally used in the past by the gas man. The sub-committee has carefully gone into the matter of which values are the better ones to use, and after a thorough investigation believes that the data generally used by the gas man are incorrect to a certain extent and that in all our future calculations regarding flame temperatures it will be adviseable to use the information embodied in this book.

The subject of preheated air and the effect it has on increasing the flame temperature of the fuel is discussed. A curve is embodied which gives the flame temperature of different commercial gases under conditions where the gas and air for combustion are preheated to different temperatures.

Chapter seven deals with the various phases of the subject involving the analysis of furnace gases. It attempts to bring out an accurate means for making the analysis of furnace gases and determining the heat losses of a furnace, the efficiency of combustion of a fuel, and just what conditions have to be corrected in bettering furnace economy. Information is given on the various methods of flue gas analysis with complete details and instructions on the correct use of what is practically our standard equipment—the Orsat apparatus.

Chapter eight is devoted to the subject of "Recuperation and Regeneration." While these methods are not of such great importance today, the sub-committee feels that as time goes on recuperation and regeneration will be more generally applied to heating operations, and for this reason is justified in devoting an entire chapter to the discussion of this most important subject.

The chapter deals with the enormous amount of heat which is wasted in the flue gases and the various means we have at the present time for utilizing this heat. It points out that by far the most general and practical means of saving some of this heat is by preheating our air by either the continuous method of recuperation or the intermittent method, generally called regeneration.

Methods are given which show how to determine the higher efficiencies and better economies that can be obtained by recuperation and practical examples are given illustrating these points. The chapter ends with emphasis placed upon the fact that recuperation is correct in principle and offers to the gas industry a great opportunity in building furnaces which will operate with very high efficiency and allow the industry to successfully compete with the apparently cheaper fuels, namely coal and oil.

The last chapter is devoted to the most important subject in the entire field of combustion—a discussion of the various factors which affect the efficiency of utilization of our different commercial gaseous fuels. The fact that one gaseous fuel can be utilized with greater efficiency than another and that one heat can be of better quality and greater effectiveness than another is discussed in detail. The important characteristics of combustion of our different fuels, are presented in great length. The most essential of these are heat content per cubic

foot of flue gases, flame temperatures, and flame propagation.

A discussion is then given of how these characteristics of combustion affect the efficient application and utilization of the fuel. Also the many factors which enter into the practical application of gaseous fuels are given and the manner in which they affect the characteristics of combustion is explained. Among these factors are degree of intimacy of air-gas mixture at the burner, air necessary for combustion, inerts in the combustible gas, etc., all of which play an important part in quality, effectiveness and efficiency of any gaseous fuel.

The folly of our present inadequate gas standards is emphasized and an endeavor is made to apply the information embodied in the chapter and show why the low B.t.u. gas distributed by some of our gas companies has actually proven more effective and efficient per B.t.u. than the old 600 B.t.u. gas formerly distributed. The general subject of lower B.t.u. gas is discussed, involving its economy and manufacture and its general value and advantages to both the gas company and the consumer.

In preparing this book, an endeavor has been made to explain the different thoughts in the most non-technical manner possible. However, various chapters contain a great many technical expressions and calculations which could not be avoided.

In the past the gas man has generally thrown up his hands in despair whenever he came across a mathematical calculation or technical discussion. Certainly such a viewpoint is entirely wrong, and to a great extent is responsible for the general lack of progressiveness which has existed in the gas industry through the past hundred years.

The gas business is a technical activity and it is the duty and obligation of every gas man to master a sufficient amount of the technique of his own profession so that he can well understand the fundamentals which are absolutely necessary for the proper appreciation of the importance, scope, and potential possibilities of our business.

The sub-committee on combustion feels that the time has come when each and every gas man should undertake to make himself familiar with the fundamentals of his profession. The book on combustion in its final form will contain the meat, the essential facts and fundamentals of gas engineering. It will give each and every man an understanding of the basic factors and considerations of our activity and allow him to see our industry in the right light so that he will become cognizant of the great opportunities that lie before us, particularly in the industrial heating field.

In this report the sub-committee has expressed a great many ideas and viewpoints with the hope that each one present will give at this meeting his suggestions, criticisms and recommendations, so that when this book is published it will not be the work of one man or of one sub-committee, but will represent the knowledge, experience and objectives of the entire Industrial Gas Section.

DISCUSSION

J. Zander (Chicago, Ill.): In my work as engineer in the industrial field, I have found that when we come to a real heavy job of high temperatures that

there is no information available. I do not know how to figure it and nobody else seems to know what happens in our furnaces under very high temperatures. We have only touched on this from one angle, by trying to find the cubic contents necessary for good work for combustion in our furnaces. There does not seem to be anything available in the way of information as to what extent that is changed or is modified as the temperature goes up due to the decreasing ease with which carbon monoxide and carbon dioxide combine and finally cease to combine under all temperatures.

Whenever we have a mixture of gas, no matter how intimately it is mixed at the injection point or burner point, we do not know from the analysis of flue gases what combination we have in contact with our material, whether we have CO_2 plus O running alongside of it, doing damage in the furnaces, not how to avoid it. Quite often we have had problems where we have been puzzled and have made calculations. It must be due to some of these conditions but we seem to be entirely in the dark at the present. I do not know what the conditions are in a furnace, say with a temperature of 3000° F, and I do not know if anyone else has found out so far. That information would certainly be valuable.

H. O. Loebell (New York, N. Y.): I am happy to say that that is covered in this book. If you start a discussion along those lines you will have a long-drawn-out affair.

J. Zander (Chicago, Ill.): Will it be covered in that book? For instance, what we may expect at a temperature of 2800° F. in conditions?

H. O. Loebell (New York, N. Y.): You will be able to calculate it.

E. L. Milener (Baltimore, Md.): We are not able to do that now.

T. B. J. Merkt (Brooklyn, N. Y.): In the synopsis of the report of the Bureau of Standards it states that at cooking temperatures the efficiency is practically the same—it does not vary with varying B.t.u. gases. I think the varying efficiencies with different gases in the higher temperatures should be included in the book. Another item to be considered in the report is the effect of products of combustion upon various materials that might be heated directly by gas.

The Chairman: I may say that I do not believe that any attempt has been made to include tests for merely facts as such and I believe that statements which are made in the book can be taken as facts. If statements appear in the book that gases of various B.t.u. content have different efficiencies under the same application I am quite sure we can accept them. I do not mean to shut off any suggestions or criticisms, because we want them.

H. O. Loebell (New York, N. Y.): I will quote from the book—"The efficiency of any kind of operation depends upon the differential temperatures. The B.t.u. embodied in the products of combustion of natural gas are 86.6 B.t.u. per cubic foot of combustion, coal gas 89.5, blue water gas 102, producer gas 73. You have 73, 102, 89.5, 86.6 and the one that has the higher B.t.u. production per cubic foot will give you the greatest differential, therefore the greatest efficiency, all other conditions being equal."

W. D. Thompson (Chicago, Ill.): I understood from your paper that on regeneration for preheating you were

able to get higher flame temperatures than without it. Is that correct?

H. O. Loebell (New York, N. Y.): Yes sir.

W. D. Thompson (Chicago, Ill.): What proof have you of that?

H. O. Loebell (New York, N. Y.): You have a longer flame.

W. D. Thompson (Chicago, Ill.): Do you not get higher flame temperatures with a shorter flame?

H. O. Loebell (New York, N. Y.): If you are going to go into the technical details it will take more than a meeting to decide those things. The flame temperature is the result of the total amount of heat embodied in the gases which carry that heat. The heat of combustion of a substance, divided by the weight and specific heat of the product of combustion will give you a rate. If you have increased the volume of heat in the gases and have a greater number of heat units to divide for weight, theoretically that is a higher flame temperature. But due to the dissociation factor, due to the lack of affinity spoken of a while ago, that additional heat put back into the form of a sensible heat does not manifest itself in the flame temperature but maintains the flame for a long period of time until the absorption has taken up that particular amount. You do not want a longer flame than you would have ordinarily.

W. D. Thompson (Chicago, Ill.): But as I understood it, the more B.t.u. per cubic foot, the more efficient the gas. Without preheating you have a denser gas and a denser combustible mixture Your B.t.u.'s are nearer together and the gas does not require the energy that a preheated gas would require.

H. O. Loebell (New York, N. Y.): No sir, that is not true. You get that in talking about volumes of gases without atmospheric conditions, that is true, but talking about gases reduced to atmospheric conditions, there you have a greater unit of B.t.u. per cubic foot.

W. D. Thompson (Chicago, Ill.): But it is not atmospheric conditions. With preheating you require a larger combustion chamber.

H. O. Loebell (New York, N. Y.): I do not see how you could. You reduce the quantity of fuel and get the same result with less fuel.

W. D. Thompson (Chicago, Ill.): But the products of combustion will require a larger volume.

H. O. Loebell (New York, N. Y.): I do not see where that has anything to do with it.

N. T. Sellman (New York, N. Y.): I think with the higher temperature your gas will expand and occupy a larger space.

W. D. Thompson (Chicago, Ill.): The gases entering your combustion chamber will require a larger chamber than without preheating.

H. O. Loebell (New York, N. Y.): Why not do it the other way and reduce the volume of the gases for the same chamber?

W. D. Thompson (Chicago, Ill.): It is the actual heat units you want in the chamber.

H. O. Loebell (New York, N. Y.): You have them in a sensible form. Why reduce them to combustible form?

W. D. Thompson (Chicago, Ill.): I mean a certain amount of heat in your combustion chamber. You must throw

in a certain volume of B.t.u.'s through regeneration. Must you not throw in a larger volume of gas of combustible mixture than without preheating?

H. O. Loebell (New York, N. Y.): Why?

W. D. Thompson (Chicago, Ill.): Because you have an expanded form.

H. O. Loebell (New York, N. Y.): But I am reducing the total quantity to the same number of B.t.u.'s.

W. D. Thompson (Chicago, Ill.): Yes, but you have a larger volume.

H. O. Loebell (New York, N. Y.): Well, what about it?

W. D. Thompson (Chicago, Ill.): It will require a greater amount of heat. You will have a greater radiation volume.

H. O. Loebell (New York, N. Y.): In other words, your idea is that regeneration reduces the efficiency of the furnace. It is just like the fellow who says, "I am in jail, come and bail me out." "Why, you can't be in jail." "But I am in." That is the same thing—you say it cannot be done, we will prove to you at any time you want the facts of the matter. It is being done. The entire steel industry would not be where it is today if it were not for regeneration and recuperation.

W. D. Thompson (Chicago, Ill.): But is it not in reducing your flue temperature?

H. O. Loebell (New York, N. Y.): That is simply incident to the result and certainly not the cause. We are not going to reduce flue temperature—rather we would build smaller stacks and get the same result.

W. D. Thompson (Chicago, Ill.): If you have a furnace working 3000° you will have to have a flue temperature of a little bit above that. You want a working chamber in that. If you can reduce that through flue temperature by putting heat into the material coming in so your eventual flue temperature is 800° to 1000°, you will get the same thermal efficiency as if you put that back into regeneration.

H. O. Loebell (New York, N. Y.): That is exactly what you are doing. Instead of regenerating the air you are regenerating the material, but it is regeneration just the same. I will show you where it applies. The melting of steel requires somewhere around a temperature of 3000°, producer gases being used exclusively, outside of oil. Without regeneration it produces about 2500° to 2800° and that would never melt steel. They regenerated that and learned to boost that flame temperature to the point where it would melt steel.

W. D. Thompson (Chicago, Ill.): I experienced in a welding furnace almost that same thing where a man claimed we would never get the temperature without a regeneration. We are working up into efficiencies that are comparable with the forging furnace.

H. O. Loebell (New York, N. Y.): Probably the claim was wrong. You get the temperature which is close to the maximum of gas for cold air, concentrate that flame in one place and do not allow it to recede and you get a higher temperature without regeneration.

W. D. Thompson (Chicago, Ill.): You mean you get it with less cubic feet of gas per unit of production?

H. O. Loebell (New York, N. Y.): One would bring into sensible form some B.t.u. you could save in chemical energy.

REPORT OF THE COMMITTEE ON HOTEL AND RESTAURANT USES

J. B. Allington, Rochester, N. Y.

I want to call attention to one thing and that is that in the hotel and restaurant business you must be very careful in the selection of the appliances to be used. We had an experience in Rochester a short time ago when a large apartment house hotel was built and we were not given a look-in on the sale of appliances. The appliances were specified by an out-of-town architect and installed. The chef could not get within four feet of those ranges while they were in operation, and within two months we had taken all of that stuff out, had junked it and put in first class equipment. When we went over there the chef was dancing up and down and said he did not know that it could be done with gas after his first experience. It shows that you have to be careful in the selection of your appliances.

One of the most important problems of the gas company today is to improve the load factor of both manufacturing plant and distribution system. This can be accomplished only through the efforts of the sales departments in stimulating the sale of gas to large consumers who will use the gas during off-peak hours. The hotels and restaurants constitute our greatest class of such consumers. One heavy-duty hotel range section alone consumes approximately 1500 cubic feet of gas per day—as much as the average home user in a month, and a large part of this is consumed at night. Aside from this, there is the consumption of all the other appliances used in the kitchen. There is the broiler, steam table, the coffee urn, the toaster, the steam broiler, the water heater, the plate warmer and the bake oven.

Picture to yourself the Main Street lunch room, not the large elaborate well-known mecca of the tourists and shopper, but the refuge of the hurried business man, the white-tiled dairy lunch. In such a one the equipment consists of three sections of heavy-duty hotel range, a combination toaster, broiler and cake griddle, a short order stove, and a battery of coffee urns. The consumption of these appliances averages 5000 cubic feet of gas per day, all of which is served through a two-inch service and one 100 lt. B meter. This gas serves 1500 people each day at a cost of three cents per meal served.

Aside from the desirable load factor and large volume gas sales this business is also desirable to the gas company because of the possible merchandising profit. A single salesman in a fair sized city can average $40,000 gross sales per year.

This salesman, however, has much in the way of competition. A large number of hotels and restaurants are still using coal or coke; some, but very few, are using oil and some are now using electricity. The greatest competition in

the past has been coal, and some chefs still cling to their old coal ranges and are still to be shown that gas is superior. This coal competition, however, is rapidly passing and we must turn our attention to the newer competitor, the electric man.

The electric man has a quality article capable of doing excellent work and is rapidly developing a business. In order to meet this competition our gas man must become an electrical engineer overnight and be able to refute his arguments. There is a belief held by some that where there is a private power plant and demand for exhaust steam that electric energy is a by-product of the steam and therefore costs nothing. This is far from true and the gas salesman must be able to show that where the demand for electric energy for cooking and the demand for exhaust steam for heating do not come at the same time, that the electric energy does cost money, and he must be able to figure the marginal cost of this energy. He must be able to point out the advantages of gas over electricity from the standpoint of continuity of service, speed of operation, cost of maintenance, and floor space required. There is little to be feared from electric competition where central station power is used, because electric energy must be sold for less than one cent per kilowatt hour to successfully compete with gas on a cost of fuel basis and there are few cities in this country where electric energy can be purchased at this price.

Gas has every advantage over coal for hotel and restaurant use. However, the chef must be convinced of this and it is our problem to educate him. He must be shown that he can stand near a heavy-duty gas range in operation with comfort and that he does not have to step aside to allow a fireman to stoke his fire. Such improvements in working conditions should appeal to him strongly. He has perfect heat control at all times and does not have to worry about draft or fire conditions. When he has nothing but his foods to occupy his mind he should certainly do better work. A gas range has more hot surface available than a coal range of the same dimensions. This means a saving of floor space and a more convenient working space for the chef. The decrease in shrinkage of meats in a gas range makes it possible for the chef to serve a more tasty roast.

For the owner we have a different method of approach but arguments that are just as convincing. The first is the service, and this is spelled with capitals. Continuity of supply is of prime importance and will interest the owner, but not unless it is a continuity of supply of good gas at good pressure. The promptness with which service complaints are remedied must be demonstrated. The inspection service and free adjustments must be explained. It will usually be found that the actual cost per ton of coal used is just about double the price per ton of the coal. This is due to cost of storage space for coal and ashes, the cost of hauling ashes, the labor for removing ashes, the labor for building and attending the fires, the additional labor required to keep the kitchen clean, the increased cost of redecorating, flue cleaning and repairs, and the cost of charcoal.

Due to better working conditions, there is a smaller labor turnover and the help is always better satisfied. Flexibility of service is important and due to the portability of gas ranges temporary kitchens may be set up. Shrinkage of meats is also of importance to the owner. The shrinkage in a coal range

amounts to 33%, while in a gas range it is only 25%. To a hotel using 1000 pounds of meat per week this would amount to 80 pounds, which at 25c per pound would be a saving of $20.00 per week or $1040 per year, enough money to buy and install about three heavy-duty gas range sections.

Capitalizing all the advantages of the use of gas over solid fuel at their true money value, it may be seen that the gas rate is not necessarily a factor and that the small town with the high gas rate can also enjoy the benefit of a hotel and restaurant business.

It has been the feeling of your committee that there has not been enough literature available to the gas salesman to adequately instruct him in the hotel and restaurant business. The available literature is largely made up of catalogue data and some sales arguments, but nothing relative to kitchen layout and design or technical data pertaining to the equipment. With the idea of supplementing the available literature with a technical booklet to be sold to gas companies, a committee was appointed, consisting of Mr. J. P. Leinroth of the Public Service Gas Company of Newark, N. J., and myself.

The booklet has been prepared and following revision and the final editing will be ready for publication in the near future. It is attractively gotten up in a convenient form and contains descriptions and cuts of various classes of equipment, layouts of different types of kitchens, gas, water, and steam consumptions of various appliances, sales arguments, and some information relative to the proper selection of appliances for different services.

DISCUSSION

O. L. Maddux (Kingston, N. Y.): There is one point which was not mentioned as being covered in the booklet and that is in regard to electrically operated ranges. Nothing is said about the difference in the amount of the investment and the depreciation on the equipment, which should be taken into consideration. It might be well for us to get an idea of the length of time that an outfit like that would last, or what the depreciation value would be per unit of hundred dollars cost, and what the cost would run so we can get comparative costs.

J. B. Allington (Rochester, N. Y.): I might add that the greatest weakness of the booklet in its present form is the dearth of material on electric ranges. But the booklet will be supplemented with that information before it is published.

H. E. G. Watson (Toronto, Can.): I would like to ask if a dishwashing machine is considered to be a gas appliance and if so whether the booklet will tell anything about it? There is another thing mentioned there, about the work of hotel and restaurant salesmen. Have I understood it correctly, that the average salesman should make a pretty good merchandise profit by selling about $40,000 worth of appliances a year? I would like to know if that man selling $40,000 worth of appliances a year is considered an average salesman, extra good, or extra poor. I know our salesmen do not do it. Perhaps that is a confession.

J. B. Allington (Rochester, N. Y.): In connection with the dishwashing machine, we do include tables in the booklet showing the water consumption of dishwashing machines, and of course that means gas consumption in the water heating. In the Hotel and Restaurant Booklet we have not enlarged upon the use of gas for water heating because there is a separate booklet on Water Heating which is supposed to cover that and we did not want to infringe on the ground of the other committee.

In connection with the salesman, Mr. Yeomans of our company is here and maybe he will tell you about it.

B. B. Yeomans (Rochester, N. Y.): I might say that I have not quite reached $40,000 but I have to do a lot of work along with my sales. I find you have about half of your time to spend selling the goods and the other half talking with chefs and the men you sell to, getting them lined up and keeping them satisfied after they are lined up. It is very necessary to have a good service man on the job after you get the job if you want to keep it.

The Chairman: I believe that subject of maintenance would cover a pretty wide discussion—maintenance methods, how to properly maintain and inspect equipment after it is installed, etc.

B. B. Yeomans (Rochester, N. Y.): In Rochester we give a free service on all adjustments of hotel and restaurant equipment and simply charge for repairs.

R. G. Munroe (Denver, Col.): I think we ought to give some consideration to the advisability of a gas company being in a position to not only lay out the kitchen but to sell nearly all of the equipment necessary. Years ago when we commenced our restaurant solicitation we found we frequently lost a good order because the prospective buyer had to go to a coal range house to buy some minor equipment and there the coal range man had his chance and we lost the order.

If I understand Mr. Allington correctly, his company is in position to completely equip a kitchen. Where a company is gas and electric, as my own company happens to be, you can take in electric potato peelers, toasters, dish washers, gas heaters, dough mixers, etc. But I believe even though you are a straight gas company you should sell enough equipment to minimize the visits which the prospective buyer must make to the coal range house. A large company should surely be able to meet that competition. We do not wish that man to be obliged to call at the coal range manufacturer's place.

The Chairman: In our own case I may say that we have made arrangements with some dealers who handle complete equipment. We find that in bidding on new installations it has been the custom of the architects to take a complete bid and it is easier to take a bid on the complete kitchen than it is to divide it. For that reason we have made arrangements to obtain through local dealers, a jobber's complete equipment, complete in every way. I think it is advisable to do that.

To assume a case—We have a man who comes to the gas company. He is going to open a new restaurant. We have on display ranges, broilers, toasters, griddles, stoves, and a few appliances of that sort. We can take this man directly down to the dealer's display room, quote him prices on all of the equipment which the dealer has, sell it

to him at his prices and ourselves get a commission, or discount from the selling prices of 30%. In the case of a proposition where we are bidding on specifications, we take the specifications to the dealer, work them out with him, etc. On the other hand, the dealer can come to us and buy any appliances that we have at a discount of 20%.

J. F. Quinn (Brooklyn, N. Y.): Under those conditions, I can see where the man from Rochester can sell $40,000 worth of equipment in a year.

The Chairman: We have an interesting program tomorrow. We have a discussion of two other booklets and a symposium wherein we expect the manufacturers to take an active part, to tell us what they are doing and what they expect to do in the way of developing new and better appliances and what they are going to do for us. I am sure you will be well repaid for coming back tomorrow.

ADJOURNMENT

SECOND SESSION

Thursday Afternoon, October, 18, 1923.

REPORT OF THE COMMITTEE ON HOUSE HEATING

E. D. Millener, Baltimore, Md.

The use of gas in central house-heating plants has opened up possibilities for the sale of gas that were formerly not dreamed of. From a small beginning ten years ago it has rapidly grown to such size that today it presents to our colleagues in the manufacturing and distribution departments one of their largest problems, but at the same time opens to us the greatest unsold field ever presented.

I do not suppose that there is any current subject being more broadly discussed by gas sales managers and engineers than that of house heating. Honest differences of opinion have arisen as to how far gas companies should encourage this class of business with their present rates, generating and distributing systems, and to what extent provision should be made in the future to sell gas for space heating. Since this discussion first began, several things have happened.

First, the public mind has ceased to class gas heating purely as an expensive luxury, but now regards it as something highly desirable and ultimately within reach. In this respect it occupies the same position that cooking with gas did twenty or twenty-five years ago.

Second, while the principles underlying the correct application of gas to central heating plants were known to comparatively few men five or six years ago, enough work has been done since that time to cover every kind of application.

Third, standard equipment is now available which will take care of any type of heating job likely to be encountered. The number and character of inquiries received, both by Association headquarters and at the several cities where considerable house-heating work has been done, convinces your committee that there is a constantly growing desire on the part of gas men for knowledge on this subject, which desire is receiving its impetus from the inquiries consumers are making of their local gas companies.

A "Handbook on Central Gas Heating Practice" can be of value only if it meets the needs of those who will use it. An open discussion by those most interested will bring out these needs. In gathering data which will form the basis of such a book, your committee has been faced with the fact that nothing approaching a standard practice exists. A survey of the country has shown that in hardly any two localities is there complete ac-

cord in methods of applying gas to central heating plants. This can be accounted for by the fact that the science being a new one, there is still much experimenting going on and various ideas are still being tried out, many cities today duplicating tests that were conducted in other localities several years ago. However, no one can say with certainty what will ultimately be considered the best practice when applied to all local conditions, and it is only through a wide dissemination of present-day knowledge that we can expect the science to advance.

Your committee believes that a "Handbook on Central Heating Practice" should be divided into three parts. First, a broad outline of the subject, showing general methods of calculating costs, load factors, comparisons with other fuels and an outline of troubles likely to be encountered with suggestions for preventing their occurrence. The second part should present in detail the complete local heating practice of each city that is pushing the sale of gas for heating purposes. Every practice adopted by the various companies has some reasons back of it and a thorough discussion and explanation of these reasons should prove of great value to everyone actively engaged in house-heating work. The third part should contain a description of all available house-heating equipment, written especially for the heating engineer and salesman, together with designs of connections, and methods of operation, repair and maintenance.

Forgetting for the moment the question as to whether or not it will help the load factor of the plant to encourage gas heating, if any such business is taken on, it will fall to the province of the members of this section to make the application. I do not believe it is possible for the gas company to greatly influence the type of building construction in vogue in any particular city. Likewise, I do not think that we can dictate the kind of heating plants that will find favor with property owners. This means that we must take conditions as we find them and make our installations accordingly. Thus, on the Pacific Coast, where hot air heating has always been most popular, hot air furnaces are being energetically pushed, while in the east the greatest effort has been made to popularize steam and hot water boilers. Regardless of the section of the country in which one resides, his knowledge of the subject is incomplete unless he has a thorough understanding of all systems.

Viewing the question strictly from the utilization standpoint, there are several things that must be considered. Gas boilers and furnaces must be simplified. All accessories that are not easily understood by the average consumer must be eliminated. We have seen great changes in boiler and furnace design lately, but it behooves every one of us to cooperate with the manufacturers to the limit of our ability in helping them still further perfect their products. More money is being spent and more people are today working and spending time on automatic oil burners for space heating than ever worked on gas heating, and if we are to successfully meet this competition, it must be with appliances that are simpler and easier to operate than oil burners.

Safety must always be uppermost in the minds of those who design and install gas heating plants. There is potential danger in every plant that is not properly designed, installed and operated, and we must take the greatest care

to see that every necessary safety precaution is taken whenever an installation is made.

The impression exists in some quarters that a gas boiler does not need as large a flue as a coal boiler of similar rating, but it has been the experience of some of us that chimneys equally as good as those used for coal boilers are necessary if the best results are to be secured. While no flue is better than a poor one, efforts should always be made to connect heating plants into chimneys of ample size, and with a positive draft.

A subject of paramount importance is the handling of condensation in flue connections and chimneys. Under certain conditions, condensation is bound to appear. If the chimney is not lined, the only way to prevent moisture from seeping through is to line the chimney with cement or terra cotta. If conditions are such that condensation in the breeching cannot be prevented, there is only one thing to do to make the flue connection permanent—that is, make the pipe of an acid-resisting material. I have heard of companies adopting various so-called rust-resisting materials, but in Baltimore, where we conducted tests extending over a period of more than five years, we were forced to use either terra cotta, sewer pipe or pipe made of solid sheet lead. Due to the great bulk of the former, and the difficulty encountered in erecting it, and installing the proper draft hood, we have now standardized on 1/16″ sheet lead flue connections and are thus sure of permanent jobs.

The maintenance and servicing of house-heating installations present problems that are new with the growth of this branch of our business. Unlike most industrial appliances, these installations are not under the constant care of an operator more or less skilled in making repairs and adjustments, and whose continued employment depends upon the gas appliance being kept in operation. House-heating jobs are placed in an out-of-the-way section of the building and unless the owner takes a personal interest in his plant and has some mechanical ability, the furnace will receive very little attention indeed. The importance of this is apparent when one realizes that the average plant consumes about 400 cubic feet of gas per hour, which is far greater than any amount of gas formerly liberated in the basement of residences. When it is realized that this amount of gas is controlled entirely by mechanical devices and that, unlike instantaneous water heaters, it burns for hours when once turned on, it can be seen that every detail of the equipment must be in perfect working order at all times.

Who is to assume the responsibility of seeing that this isolated equipment is kept in perfect working order?

There are certain details of the plant that the average customer cannot take care of, however willing he may be. For instance—valve trouble, flue trouble, burner trouble and thermostat trouble. Add to this the tendency of salesmen to promise automatic heat without any attention, and Mr. Customer generally declines to learn anything about the operation of his plant. Surely the gas company cannot forever assume the burden of the detection and remedy of every ill, petty or otherwise, that heating plants are subject to. This problem of maintenance is not so serious when a company first begins installing heating jobs, and all appliances are new, and either the superintendent or some cadet engineer are nursing them along. But when the business reaches the real com-

mercial stage and the number of jobs on the lines reaches up in the hundreds or the thousands, and the boilers get old and dirty, that is the time when their proper maintenance becomes a real problem. Some companies only send out on these jobs when the customer requests it. But does the customer always know whether or not his plant is in need of attention? I do not believe he does. Yet he demands instant service on the first cold day of the year at which time he sends a hurry call to the gas company to turn on his plant. In Baltimore only last week we received hurry calls from over one hundred customers in one day, to light pilots and turn on their plants, and as it was necessary for our own protection to assure ourselves that each job was mechanically right before we left it, it can be seen what a tax it is on the company to render the proper kind of service at the instant the customer wants it.

Every company that wants to and does undertake to sell central house heating is immediately confronted with the question of converting coal boilers to the use of gas. This is due to the cheapness of converting coal boilers and furnaces compared with installing gas-designed equipment. Most companies have discouraged such installations and it is generally recognized that only in extreme cases will the operating cost of a converted job be as low as that of a gas-designed job. Mechanically, the operation of converted equipment can be made quite as satisfactory as gas-designed equipment, when the former is properly designed and installed, but the fly in the ointment is the attempt of plumbers to secure some of this business with inferior burners installed in an improper manner. It is impossible to expect plumbers to install good converted jobs, and unless a converted job is installed with the greatest care by recognized experienced men, dissatisfaction with the company will surely result.

However, it is possible to standardize on converted jobs to a certain extent. In Baltimore we have worked up a standard method of converting boilers and furnaces, which has been closely followed in Denver during the experiments that were run there last season. While the Baltimore company does not at present encourage the installation of burners in coal furnaces, I personally installed over 150 converted jobs five or six years ago, most of which are still in use. And a remarkable thing that I particularly wish to call to your attention is that not only has the operating cost of these jobs been entirely satisfactory, but the number of complaints per job per season consistently runs less than for gas-designed steam, hot water or hot air installations.

Undoubtedly a demand for gas heating exists today and will continue to exist in the future. Due to the difference in cost between coal heating and gas heating, we must use judgment in applying the latter. This applies both to the conditions of use and the financial standing of the prospect. We must bear in mind that the tendency is for all classes of people to install gas to a greater extent each year, but that most companies are not yet in a position to take on the load. Under the circumstances it is the duty of gas-heating engineers to properly direct its application in the interest of both the customer and the company, as the business can only endure when the needs of both are served.

W. K. Eavenson (Fall River, Mass.): Mr. Milener, did I understand you to say that you have trouble with condensation in brick chimneys, condensation seeping through the brick? What would you do with a brick chimney built within the last fifty years?

E. D. Milener (Baltimore, Md.): First of all I would try to persuade the customer to continue to use coal. Chimneys fifty years old are bad, very poor, and the mortar used is even poorer. If possible, where the chimney is large enough, break the chimney at each floor and line it with terra cotta. Unless you can do that you are inviting trouble unless it is an inside chimney. If it is an inside chimney and can be kept warm on all sides, the chances are you would not have any trouble. On the outside chimney, when condensation appears it will help to line that chimney.

C. C. Krausse (Baltimore, Md.): It might be well at this time to ask a question on maintenance. Will you outline our method of servicing boilers and some of the trouble encountered? I think we might get a lot of discussion on that.

E. D. Milener (Baltimore, Md.): The problem of servicing house-heating jobs I think is different from servicing other types of plants on our lines. You get practically no help from the owner. We have tried various methods of getting the owner interested and have not succeeded to any great degree. It has meant that the whole burden has fallen on the gas company. Our present practice, and we do not see how we could cut it down to any smaller expense, is to inspect the job every summer. We find the summer inspection of more importance than the winter inspection. Repairs must be put in and the job must be gotten ready and put in a safe condition before the cold weather comes. Then we stand subject to call throughout the winter. We make one unsolicited call during the summer and one during the winter. We find it absolutely necessary to make two unsolicited calls during the year and are ready to make service calls at any time.

O. L. Maddux (Kingston, N. Y.): On the question of maintenance, would it not be a practical idea when making the installation to have a standard form maintenance contract that the companies have worked out, with the cost of that inspection, say, after the first year or after the second year,—whatever period you wished free inspection,—and following that let the customer be billed on his gas bill immediately after the inspection is made on a regular contract form. That is a thing that will not have to be considered until we get a certain number of appliances on our lines. Otherwise, I think that would be a good way to handle it.

S. R. Ross (Philadelphia, Pa.): Most of you gentlemen are, of course, talking from the gas company's point of view on maintenance. The boiler firm which I represent has been operating in Philadelphia for the last four years. The first year was very meagre in its operations, the second considerably better, and so on. We tried to maintain a service during the winter months of at least one monthly visit to each installation and we are going to try to maintain that same kind of inspection. It is a fact that most of the time you go to the appliance and give it the once-over, with a good skillful eye and you leave it. At other times

you will find that one or two little things look wrong and need adjustment.

This summer we made a summer inspection to see just what damage had been done in the former years of service, averaging about three years. We found a white powder that falls down on the burners—I suppose it is copper sulphite—was quite prevalent and it needed cleaning out. We bought a vacuum cleaner and devised tools, especially designed for the cleaning of our own boiler. We start the vacuum cleaner, stick the tool in and it picks up the white powder and does not permit it to get around the house, causing annoying conditions in the lungs, nose and throat.

We are next year going to notify the users of our boiler that we strongly urge them to have us inspect and give service to them, and I think we will charge about fifteen dollars for that service. That is due to having to travel anywhere from a short distance up to eleven miles and back to give the service. If we find we can give it to them any cheaper, we shall.

I would like to make some remarks on what has been discussed in the main paper. First, we have a handbook. It has information in it that has been very strongly verified here. Its theoretical figures, based on B.t.u. values and what the B.t.u. should do, are placed alongside of actual work done through periods of any length of time at any certain given temperature. We calculate our gas consumption on the amount of what we term gross radiation, taking the radiation of the radiators, adding 25% and calling that the gross system. It is on that figure that we calculate our gas consumption. In the booklet you will find a certain coefficient for so many hundred feet of radiation per day on an average. Those figures have been borne out very well—in fact, I would say in 90% of the cases where we have applied an estimate of the gas consumption, the gas consumption has not quite reached them, in a few cases it has run over them.

When we sell on that kind of an estimate and the gas consumption does not reach the estimated quantity which we give them, you have a satisfied user and we have made a friend for the gas company. High gas bill complaints quit as soon as that kind of appliance is sold because it is sold right.

I would be very glad to send this book to any one who will inquire for it.

Mr. Wheeler has just called my attention to another little charge. We have had calls similar to those they have had in Baltimore—to run out and light boilers—and we are getting the cost on that. On a hot water job we figure a cost of about $3.00 for merely lighting it up; on a steam job about $5.00.

We have on our own steam boilers the automatic water feed and overflow and also the automatic fuel control valve. Those two accessories need skillful and tactful adjustment for they are somewhat delicate. The fellow turning the screw driver must know what he is doing and consequently it takes a little more time to do a steam job than a hot water job.

The load on the heating plants strikes me in this fashion. I know you will have a peak load in the winter time but that peak load is not going to come to you tomorrow—it is going to come gradually. In a certain city not far from here I recently had the information that one of the districts had to put a booster line on a certain territory because the

gas-fired boilers were going in and the pressure was so much reduced that there was not the proper amount of gas supplied there. That is one of the conditions that is going to arise, no doubt, but I think all the gas companies have available means of producing that extra pressure to supply the extra volume. It is not going to come on suddenly and it can be taken care of in that way.

It seems to me that during seven months in the year it is a much better proposition for a gas company to have a customer that is paying on an average of fifty or sixty dollars a month return to the gas company, even if they do have to have a stand-by service for the other five months, than that same customer today only paying four, six, eight or ten dollars.

I wish to commend the remarks about the simplicity of the appliance. We have inquiries coming to us that are competitive, perhaps, with oil burners. I think our strongest point, and the strongest point for any concern selling the gas-fired boiler is simply to say, "There it is in its simplicity." There is no equipment that is required to vaporize the fuel—the fuel comes in all ready to burn; you have no large storage tanks or things of that character. However, as it has been remarked, if you could sell gas by the tank full, they would use that tank and then call for another and not ask the price. But that does not give them automatic service, if they did not kick over the price. There is an automatic service that it is giving, an automatic heating service, and the gas company ought to help us produce that kind.

Regarding the safety of the installation, we have had four boilers explode. That comes from various causes. In one case, a department store sent a man to install a gas range. In spite of the fact that we had tags on the meter and on our appliances, he turned off the valve at the meter, installed the gas range and turned on the valve at the meter again. During this time the boiler valve had been turned on and the thermostat opened, and between the time of turning on the meter and when the match was inserted the boiler was flooded with gas and of course exploded.

Fortunately we have learned not to fear those explosions very much because of the construction of the boiler. It merely bulges the sides and perhaps breaks the insulation brick.

Most of the other occasions were similar to that. Those are conditions which I do not believe even the gas company could take care of. We try to make the thing foolproof and put it in such shape that it will be as reasonably safe as we can make it.

The flue, as we have designed it, is one square inch of flue area to each 10 cubic feet of gas consumed per hour. That, I believe, is data which we took from the American Gas Association's Salesman's Hand Book. It is the best we have at the present moment.

The chimney that is leaking can be repaired if it is plastered on the outside. That is an additional method of doing it to that which has already been mentioned. We have found, peculiarly enough, after a coal-fired boiler has been removed and gas fuel is used with that same flue, that there is a dropping down of the soot that is clogged in that chimney. In one or two instances it has been so bad that it has clogged the flue connection with such effect that the boiler would not operate with any degree of efficiency.

We feel in Philadelphia that we are assuming quite a responsibility as a manufacturer of an appliance. We have gone through four successful seasons and we are proud of the list of satisfied users that we have there, and if any of you gentlemen would like to hear from them, we will send you that list too.

We have used heretofore a closed breeching, rather a solid breeching prepared with the open draft hood. Our friends of the U. G. I. have come after us and they urge us strongly to use the deflector type of open hood. We have conceded to their desires and we are going to equip our boilers hereafter with that, so far as Philadelphia is concerned, until we can get to a more agreeable method of handling it.

My one plea for the closed breeching is that in the case of the vent or the pilot light being extinguished, the gas being turned on full through the main burners, there is a much better chance of all that gas escaping through the flue. We will conceive perhaps that there might be on account of the closed breeching a slightly higher stack temperature.

T. M. Houlk (Denver, Col.): During the past winter the Denver Gas & Electric Light Company inaugurated a program of residence heating with gas. It is the purpose to report in this paper the conditions under which this program was conducted, the methods of installation and the economic results obtained.

The report, "Experiment in Residence Gas Heating at Denver, Colorado," gives a chart. This chart comprises 36 installations, of which 16 are hot air installations, 16 are conversions of both hot water and steam, with the remaining 4 gas-designed boilers. Some of these data had to be computed—that is in consumptions—back to the early part of October, as we have an eight months' season, starting with October and ending with May. However, the percentages of those consumptions which are estimated are so small in comparison with the total that the error introduced is practically negligible.

Some interesting things came up in connection with collecting these data and we found that the hour's use of the demand, per season average for all installations, was 1559—hot air having 1440 hours' demand, conversions 1642 and the gas-fired boilers 1711 hours. That is the order in which they naturally would be expected.

Denver is located in the heart of Colorado's lignite beds. This makes available an abundant supply of cheap fuel. It also undergoes unusual temperature conditions. A survey of average temperatures prevailing in several cities shows that Denver has the lowest average temperature during the heating season, with the exception of Chicago. It is, however, subjected to wide variations and sudden changes in temperature, a condition which is readily met with a flexible fuel such as gas.

The average cost of gas per million B.t.u. input was \$1.46; average cost of coal per million B.t.u. input, compared with the previous year or some former year, was 50¢ per million B.t.u. But when we put this on the basis of the same efficiency of operation, the cost of coal replacing a million B.t.u. with the gas is approximately 95¢, or, comparing bare costs, would give you a figure of 95¢ for coal against \$1.46 for gas, and where janitor service, convenience, removal of ashes, and other things are taken into consideration, we, in a good many cases, would equal the former cost.

(The complete paper, "An Experiment in Residence Gas Heating at Denver, Colorado," will be found on page of the Minutes of the Technical Section Sessions.)

The Chairman: I am going to ask you in discussing this subject to eliminate the question of rates and discuss merely such matters as refer to the booklet on "House Heating" which is to be prepared.

R. G. Munroe (Denver, Col.): I want to suggest that the gas company which enters the house-heating business should give a great deal of attention to the matter of proper humidification. With your permission, I want to read from a copy of the *Literary Digest* of December 30, last year. We used this effectively during our house-heating solicitation last year.

"Every year, as cold weather comes on, diseases of the air passages, such as common colds, bronchitis, tonsilitis and pneumonia, begin to show a marked increase. The reason for this is plain, thinks a writer in *Good Health*. With windows open we get a circulation of fresh air containing a sufficient amount of moisture. But with windows closed, unless care is taken, the air soon becomes unfit to breathe. Moreover, with modern methods of heating, it is soon drier than the air of the Sahara desert. This dry air takes the moisture from the nose, throat and bronchial tubes, irritating these surfaces so that they are not in condition to repel any disease organism.

"Probably the greatest fault of modern houses is the lack of any provision for furnishing humidity or moisture to the air during the time we are using artificial heat. With the old-fashioned coal range or airtight stove, it was possible to keep a kettle of water steaming most of the time. Today, with steam and hot-water heating, the problem is a difficult one, and even with the hot-air furnace the water pot is usually inadequate in size. But moisture in the air we must have if we are to avoid dry, irritated throats. Remember, also, that moist air at 68° feels warmer than dry air at 72°, so by finding a way to humidify the air of your home you will not only be advancing your health but lowering your coal bill. Various devices that attach to radiators are on the market, but any receptacle placed on the radiator and kept filled with water will serve the purpose."

This article was written in the east. We need a greater percentage of moisture and the Association, in its booklet, should undertake the development of some automatic humidifying apparatus which can be sold, not only with hot air equipment but with steam and hot water equipment.

I think our problem is largely a hot-air problem. Most of our houses in Denver are heated with hot-air furnaces and I believe they will be for some time to come. This humidification program fits in very nicely with a hot-air furnace and I believe we should make every endeavor to collect data on proper humidification, and push the sale of that equipment with our house-heating plants.

J. B. Allington (Rochester, N. Y.): I want to heartily endorse what Mr. Munroe has told us about humidity and about the hot-air system. Last spring I took a trip around the country and I want to call everybody's attention to the results being obtained with the hot-air furnace in Portland, Oregon. They have developed a furnace out there and have had it in use about twelve years and it is a

very satisfactory heater. We have built some of them in Rochester and we feel the hot-air system, with its built-in higher efficiency than the hot water or steam system and with a better load on your gas main, is a much more attractive system than the hot water or steam systems, although they are good.

I believe new installations put in new houses, even in this territory, should be sold as hot-air systems where they can be. In regard to humidity, there is the humidifier developed and patented by a Rochester man, and I believe it will be put on the market shortly, which without attention will give a constant relative humidity of at least 40 or 50%, regardless of outside temperatures, and with a water consumption of about 25¢ a month.

E. G. deCoriolis (Boston, Mass.): Allow me to digress from the trend of the discussion going on. We have been discussing from the standpoint of engineers, that is, a meeting of engineers. We must not forget these transactions will probably be published and will be read by a large number of commercial men who will be face to face with this house-heating problem.

The paper which has just been read is very instructive. If I may be permitted to be critical I should point out that in this paper the author states that he has had fully as good results, if not better, with this design, or other systems that may have been used as with gas-fired boilers. That may be all right for the larger cities where there are competent engineers to make the proper designs and see that the designs are installed and kept in operation. But we must not forget that, after all, there are only a few large cities that have engineers who can attend to the problems, whereas there are a large number of small gas companies which are going to be faced with this question of house heating.

Therefore, it seems to me it behooves us not to allow anything to go out of this section which in any way might mislead the smaller ones or might make them leap into and attempt conversion jobs which are bound to be failures and are going to back-fire on the house-heating proposition by gas.

N. T. Sellman (New York, N. Y.): I believe the paper was a little misleading in that. The way I read it was that there were 17 converted jobs, of which 14 were hot water and 3 were steam. And on the gas-fired jobs, I believe they were all steam. Is that so?

T. M. Foulk (Denver, Col.): One steam. Three gas-designed jobs.

N. T. Sellman (New York, N. Y.) So you are comparing both mixed hot water and steam in both cases? Why do you say that they are in the order you would naturally expect? I certainly would not.

T. M. Foulk (Denver, Col.): That statement referred only to the hour's use of the demand. It has a direct relation to the load factor. I did not attempt to lead anyone to believe that these consumptions and the efficiency of the gas-designed boilers were representative, because we only had those four installations to compare against the much larger number of both the other kinds. At the end of this coming season, the season we are in the midst of now, we will have more gas-designed boilers to compare with.

Have I made that clear? The only reference is to the load factor which shows the gas-designed boiler has the best load factor. That happened just

that way—there is no reason at all for it that I can see.

R. L. Manier (Syracuse, N. Y.): There is a great deal of these data available but a good deal of it is not comparable one city to another. I would suggest that if we could get our data together as B.t.u. per square foot per season, or B.t.u. per square foot per degree difference, by some standard constants such as Carpenter's, we would not be taking the existing square foot in the place but what should be there under the different exposure conditions. Then wherever we are we can immediately check that against the specifications of the building we are figuring and give a fair estimate of the consumption and what it might be.

S. R. Ross (Philadelphia, Pa.): That is just the line along which we have been figuring our data. To maintain 70° F. temperature, it is merely a matter of adjusting those coefficients for the one degree rise for various locations in the country.

E. D. Milener (Baltimore, Md.): That was considered by the committee and certainly will be incorporated in the booklet. Any data furnished finally in the booklet will be comparable one city to the other.

E. Stephenson, Jr. (Danbury, Conn.): I believe it would also be advisable at the time when we go into the degree business to go into the percentage of the total cost, taken up each month of the year. In the city of New York we have practically 25% of the total heating bill in the month of January. We find that it is necessary to sell the customer that 25% as well as the total season bill, because there is an unfavorable psychological effect on the man with a $400 bill a season seeing a $100 bill in January. He does not stop to consider that he will have only 3% of his bill in the months of October, May and June. I believe it would be well for the committee to investigate and include that in the booklet for the various parts of the country.

G. M. Karshner (New York, N. Y.): It seems to me that this question is very important to the gas company. We heard at the commercial session yesterday afternoon the statement that if we went very far into the house-heating business or if we took the total house-heating business in one city it would wreck the gas company in that city. Here we have the other statement that it is profitable business. There certainly is an extreme contrast in opinions furnished by good men on both sides. Now it seems to me that either the Industrial Gas Section or the Commercial Section should appoint a committee that is anxious and willing to work in the ensuing year and get data from the various gas companies of the country on this house-heating problem and let us see what it does to us.

I am trembling in New York all the time as to whether, when we are getting house-heating business, we are doing something good or bad for the company. I do not know when I hear men like Sam Wyer say one thing and someone else say another thing, I do not know what will happen and I certainly do not want to wreck my company. It seems to me that we should get a committee of gas men—not manufacturers of appliances, for they are bound to be prejudiced—that are ready to work, and see if we cannot get information from various companies—Danbury, New York, Rochester, and other towns that are actively pushing the house-heating game, and see what the load amounts to. Let us see if there are two or three days in the winter time when, if we did have

everybody in the city using it, it would wreck the system. Let us find out something about it. And the only way we can do that is to get an active committee.

H. H. Clark (Chicago, Ill.): I hope this section is not going to develop into a bunch of hard-headed inventors. There is enough equipment on the market right now with which you can go out and get all the gas business—industrial, house-heating and everything else—that you need. The ordinary gas company knows how much business they are doing and you do not need a slide rule to figure out how much 10% more would amount to if you translate that into boilers. It will put that much business on in five years, etc. The gas companies have been growing for 100 years, so I am told, although I have not been in the business that long, but I am not afraid of the house-heating business and I do not think any gas man should be because it will not come on next winter. We will be talking about it twenty years from now and we will not have it all then.

I think the industrial man's job is to go out and sell gas and I think it is up to some of the manufacturers, with our assistance, to build the stuff that will sell the gas. I do not like (and I am talking for myself and not for our company or any of the companies I am associated with) to see so much time spent in this town and that town, and some place else, doing the same thing and arriving at the same conclusion. I do not know how many of you gentlemen read the A. G. A. Monthly, but Mr. Sellman had an article in May that would answer most of the questions that have been brought up today about how much gas you are going to sell per month, what percentage and what conditions you would have in Syracuse compared with Denver and San Francisco. Most of the questions have already been answered and I think it is largely the fault perhaps of the Association that we have not presented the information to you in a way that would appeal to you. Publishing it in the Monthly, of course it goes to men interested in half a dozen different branches, and you might open it and read four or five pages and miss the meat of the article down in the book.

But I am much pleased to hear Mr. Milener's paper because it is a statement of facts. All of the comments based on personal opinions I do not give much weight to, because you have to differentiate between facts and opinions. That applies to some of the gentlemen who have spoken at the previous sections. They get up and make certain statements and we know that they are only opinions and, therefore, not worth much except as opinions.

I heat my own house with gas. All good gas men or good gas boosters should do that. I have first-hand information as to gas consumption and demands and instead of having a radio last winter I spent most of my time in the basement trying to find out something about house-heating. I did find out something and I found it checked very closely with the information already available. I did go into it as a matter of curiosity because I had noticed the rumblings about house heating. When I first heard it here, I thought I ought to go home and take out my boiler. I talked to Mrs. Clark about it and she said if I did she would leave me. That was reason enough to keep it in. I also talked to Charley Bradley, Chief Engineer of the Public Service Commission. Of course we were joking about it, but he said, "You will always have all the gas you want for house heating, for all your neighbors, and every customer on

the Public Service Company's lines will have enough." Charley Bradley is the son of William H. Bradley, formerly Chief Engineer of the Consolidated Gas Company, and I am much biased by his statements. I used to work for him years ago and his statements are worth a great deal to me. He has profited by taking care of every customer he has put on so far, and ten years from now we will still be talking about how cheap it is.

E. D. Milener (Baltimore, Md.) : Most of the data are already available. I have mentioned that a great many tests have been made in other cities several years ago and I cannot see the value of spending a lot of money duplicating that work just to verify the matter to date.

I would like to see such a committee appointed as Mr. Karshner mentioned. I think that committee should be a General Committee. Our job is the utilization of gas and it is up to the directors of the Association and the directors of each company to determine whether or not we can have the gas to sell for certain purposes. It certainly is our job to let them decide that and once we get it, push it as hard as we can.

REPORT OF THE COMMITTEE ON 1000 USES FOR GAS

H. H. Clark, Chicago, Ill.

The booklet "1000 Uses for Gas" has been in process of preparation for some months and it was laid on my desk Saturday morning before I came away, in complete form for the printer. It is a volume on which a great deal of work has been done and the booklet when completed will be turned over to the incoming committee for such action as they see fit to take. It is an elaborate volume. It will be valuable in its place and I hope the incoming committee will give prompt action. It is rather difficult to describe, except that a new title has been presented by Dr. Norman of our company, "A Million Uses for Gas." I do not know if that is the actual number he has classified but there is a goodly number in excess of a thousand. He has also included in the book a lot of photographs and tables and has made it in the form of a booklet which I believe should be published and distributed widely and which I believe would become quite an aid in assisting us to interest people in gas and thereby overcome some of the obstacles you meet in selling to the industrial consumer.

DISCUSSION

(Large Volume Water Heating)

The Chairman: We had listed on our program a paper on "Large Volume Water Heating." A booklet on this subject has been prepared. Working with Mr. Rasch on this booklet was Mr. Sellman, Association headquarters, and I might ask Mr. Sellman if he can start a discussion on the subject.

N. T. Sellman (New York, N. Y.): I really have not been working on the book, but there is a lot of material used which I prepared some time ago. As you know, that material is applicable only to large volume storage water heating. There is a section on instantaneous water heaters, but it does not cover, as far as installation is concerned, all phases of water heating. For estimating I think that we should go into more detail regarding domestic water heating.

I was going to rewrite my own book because I now feel cast iron heaters have one use and copper coil heaters a slightly different use. You cannot figure them the same way since copper heaters will not stand for long usage. I figured 20 hours a day the right usage. I do not mean copper is not as good, but the method of figuring must be slightly different. I would like to hear what some of you men have to say about that.

O. L. Maddux (Kingston, N. Y.): In regard to the construction of the heater for storage systems. Where they are under operation for a period of whatever the figure may be—I do not know

whether twenty hours is the figure or not—there has always been one trouble with the copper coil heater on large volume heating where the heater has to be under continuous operation the major portion of the day. After a period of sometimes even less than thirty days, they begin to require a great deal of servicing. On an average, six months has been the maximum life of the coil in the heater and some research should be made to find out just whether the conditions are caused by a choking up or a sediment, etc., that would warrant changing over from copper coil to cast iron. Personally I think it is an advisable thing to do but it is something that will require quite a good deal of study and research to find out the most practical thing. Great improvements can be made I know.

H. H. Smith (Boston, Mass.): We have some water heaters and we have had some trouble with one, a rather large installation, put in some time ago, where the coil is giving out. We have been discouraging that for the future. We shall not do it any more. We use the Bryant Heater for large users and find it very satisfactory.

N. T. Sellman (New York, N. Y.): That twenty hours I referred to is figured on twenty hours burning, maximum day only. If you do that with a copper coil heater it would be pretty heavy for it. It is a case of changing that to a four- or five-hour period and it has the advantage of cost. It will cut down on the ordinary tank size, but it begins to cut in on the instantaneous heater. It will be a large heater with a small tank instead of a small heater with a large tank.

C. C. Krausse (Baltimore, Md.): Our practice in Baltimore on all large volume water heating is to put in large tanks and small heaters, using cast iron.

The Chairman: Does anyone disagree with that method? It evidently appears that is the thing to do—put in large tanks and small heaters. I suppose the committee in their booklet will have some recommendation similar to that.

If there is no further discussion on that subject, we will pass to what we consider one of the biggest features of our program.

(Upon invitation, Mr. F. F. Cauley, Chicago, Ill., took the chair.)

PROGRESS IN INDUSTRIAL APPLIANCES

F. F. Cauley: Before we get into this particular subject, Mr. Karshner asked whether our house heating is to be handled in the future by our Industrial Gas Section or the Commercial Section, or part by each section. I do think that our house heating should be done with some engineering. That is my one thought in the matter.

A year ago, when we were striving with the Commercial Section to get more time into the industrial and the large wholesale business, we found it rather difficult. We have, in years gone by, complimented the chairmen for their great work in the promotion of domestic sales. Everything that they have done on that work is fine. But in addition to

that, we should be just as active in the large wholesale business. And so, with that thought in mind, several of us who have been spending many years in promoting industrial rates got together, with the assistance of Mr. Loebell, Mr. Clark, Mr. Stephany—I could go on down the line—and took it up with the Association and attempted to bring about what we have this year—an Industrial Gas Section. So much for that.

One of the things that I have always stood for, and thought was a very necessary asset to the promotion of large wholesale business, was that the industrial appliance manufacturer might enter into these meetings very intensively. That is, he would be a vital part of our industrial meetings and discussions. And why should he not be? I think I have stated on a number of occasions that the equipment is the instrument by which we expect to sell large quantities of gas and I think you will agree with me in that respect. It is most important. Therefore, I think the appliance manufacturer should take a very active part in all of our meetings in the future.

At an Industrial Committee meeting I attended in Pittsburgh last winter in Mr. Stephany's office, I suggested that one of the outstanding things that I would like to have would be a very large representation of the industrial appliance manufacturers at the coming meeting, and any subsequent meetings we might have. I have no doubt there are a number of our appliance manufacturers who are constantly bringing out new things; they are making progress in their equipment. Who should know it any better than the men that are attempting to sell equipment in order to secure the wholesale business?

Mr. Stephany, Mr. Loebell, and the other members attending agreed that it would be a most excellent thing and so, with that in mind, the secretary sent out letters this fall to a large number of our manufacturers, inviting them to attend this meeting and all subsequent meetings. I do not want to take up any time in this meeting. I only want to give you the thoughts that some of us have regarding this matter. So I, and I know Mr. Stephany and everybody here, would like to hear a very active discussion from people now in the appliance business on the progress of new equipment.

H. O. Loebell (New York, N. Y.): If you will allow me, I would like to take just one minute of your time to make clear to you my views so that you will not be so puzzled as to what position I occupy.

I have been in the industrial phase of this business for twenty years and am still an industrial engineer for the Henry L. Doherty Company. Years and years ago the Doherty organization decided that in order to develop its business it had to produce equipment not then available. They built up a small concern with which you are all familiar—The Combustion Utilities Corporation. We later on realized that large business was to be secured by different types of appliances and the industrial division of the Henry L. Doherty Company developed a lot of appliances of different characters. The thought afterward occurred to us that, while a manufacturer knows some of the details of the manufacturing business and knows some of the part of the business that is coming to him as a manufacturer, in order that the perspective of that appliance manufacturer be correct and in tune with the gas bills, the man who supervises the manufacturing plant must be a gas man

in daily contact with the requirements of the trade, and able to give the proper objective to that manufacturing concern.

I do not know if I am so qualified, but apparently our people think so and they gave to me the added burden of being the head of the Combustion Utilities Corporation. I have the advantage of knowing what the industry needs. I am a gas man. I go to the managers of the different properties and try to increase their load. I know also the difficulties the manufacturer has.

I may be wrong in my conclusions and in my ideas but I want you to accept my statements as being sincere and honest and the result of real experience. I want to be faithful to this section and I want to give you a thought that will help this section in the industry and your company in the way of dollars and cents.

The manufacturer of industrial gas appliances has a bigger problem than you gas men have in selling the gas—because it is in the nature of a gas appliance that it can be readily copied and readily made by a man who deals in iron, steel or refractories. A manufacturer develops a certain appliance and puts it on the market after he spends a great deal of money, but the gas man can imitate it. It may not be as nicely finished but it will do the trick more or less. In order to encourage the manufacturer to be able to produce new things and to develop the business for you as much as for himself, you have to encourage him, and it is within the discretion of every man here to say which manufacturer should be encouraged. Personally I would encourage that manufacturer who brings the greatest number of new things before us which add the greatest amount of load regardless of the prices charged for the equipment. After all, you are interested in selling gas and you usually pass along the cost of the appliance to the consumer where it belongs. Sometimes you feel that because you can obtain one appliance of a certain character—at a slightly reduced cost—you are justifying the purchase of that appliance. But you are not justified in purchasing an appliance made by a stove manufacturer in preference to an appliance made by an industrial appliance manufacturer because you are taking away a trade or business that belongs to the man who specializes in that line and who continuously gives you, besides a standard appliance, something new.

I feel that no stove manufacturer justifies the receiving of business for bake ovens, candy furnaces or burners. You may differ with me, but the profit being made on the bake oven or candy furnace by the industrial specialist is proportionately going into a new furnace or new method of burning gas. If you feel that that profit to an industrial manufacturer is something you should be able to get along without, you are not going to make progress. But if you will take it upon yourselves to analyze the situation you will come to the conclusion that his progress, his development, his growth, his financial success are going to be your financial success and your growth.

Every one of us who has been on the firing line for any length of time knows the handicaps we have had to get the proper appliance to link the demands of the manufacturer with our service. We have made a great number of attempts and a great number of failures, and the reason for it is because we thought it possible to produce suitable equipment in a home-made way. It is hard, and I believe we have handicapped the industry by that attitude.

My plea to you gentlemen is to look upon the manufacturer as the one who has the proper facilities to give you greater service, providing you will patronize him to a greater degree. Allow him his profits in order to give him an opportunity to develop his vision and the realization of his vision will make it possible for you to secure more business.

This thought I feel reflects the idea of every manufacturer. I am not their spokesman. I am trying to give you a result of my own analysis, trying to make a little organization that has been thrown into my hands grow and to make it possible for them to develop better and better appliances for your use.

So far as the future is concerned and so far as the things we have in mind to produce for you gentlemen are concerned, I would say that our ambitions are high. We aim to be in a position to have equipment on the market that will do the heating work for every single operation known in industry today. It will be impossible for us to cover the whole field. Conditions in every city differ and while we may be able to put in an equipment of our make in a certain place, in another town the conditions may be so different that the details of manufacture may have to be suited to it. There is no particular manufacturer that covers the whole field. The uses are diversified and every manufacturer fills his own line. He has certain ideals and he works along those lines. We are going to put forth our best efforts to serve you. We want your encouragement. We want your encouragement as much as possible on standard equipment, and I want to leave this thought with you—whether you should purchase equipment from those manufacturers that are helping you most, rather than purchase, probably at reduced prices, from the man that sells just so much cast iron, so much sheet steel and so much brick. You are doing yourselves an injustice by purchasing from the latter and are reducing the chances of the former to help you more and more.

R. W. Lesley: I serve another great industry of this country—the Portland cement industry. When the Portland Cement Association was organized a good many years ago, they organized a committee on new uses who projected a rainbow which they hoped to bring to the public. The new uses began with the baptismal event and ended with the coffin, with all the steps in between. But with your thousand uses for gas, I feel thoroughly sure the cement fellows are nowhere near where the gas men are.

Having gone through the pioneer days of an industry that today is one of the great ones in this country, and, as a matter of fact, consumes as many millions of tons of coal as all the gas companies in the United States, it is the charm of this new field that brings me here today to speak a little on what Mr. Loebell has so well described—the duty of the gas company to the manufacturer of a gas appliance to buy that appliance. When you come to think of it, they are your research departments and everyone who has ever gone into research knows what it costs. When we produce some special furnace that may consume 100,000 cubic feet per hour, we are doing something that gives you more than 500 domestic consumers a month. We feel that the research we do and the failures we make and the machinery we build and do not operate, are all milestones, not in our progress, but in your progress and we feel that when we spend thousands of dollars for research, throw aside all sorts of experimental work, study with the best chemists, employ the best engineers, that we are more than just

appliance makers—we are engineers. We are doing research work and we feel, as Mr. Loebell does, that in the business of this kind, those concerns that have gone through the briars and out into the rough and got scratched and man-handled and suffered all sorts of things, are entitled to, not everything, but certainly to some consideration of the fact that they have overhead and are working all the year round and that the furnaces they build are not for today only. When we put in a furnace that uses 100,000 cubic feet a day, we are contributing something to the gas company every day in the year and while we get paid only once for that service you get paid for it every month, perhaps for ten years. Yet people can imitate that furnace without our research, experience, or engineering work, and build some home-made furnace that may produce the results. We do feel that in considering the subject in its broadest lines we ought to be considered as more than just commercial people putting something in the field to sell to be left alone and not be considered afterward. We should be considered as a body of engineers giving their lives, giving their study and giving their research to this big industry.

W. D. Crouch (Youngwood, Pa.) : Mr. Loebell's and Mr. Leslie's talks made such an impression that I want to tell of an incident that happened in Cleveland. We were called upon by the Standard Oil Company to furnish them equipment for a small melting pot. Mr. J. R. Frost, the general manager, said, "We have wonderful machinery, wonderful mechanics, and we have about decided to make our thermostats ourselves." I said nothing. And finally he smiled and said, "And then I got to thinking about it and I thought of the years you people had put in to develop the controls, the immense amount of money you must have spent so that you could put that into our plants and I decided to send you into the purchasing agent to get the order."

G. A. Robertshaw (Youngwood, Pa.) : As a manufacturer of an appliance that goes on practically all fuel-burning appliances, and not as a manufacturer of an appliance which burns fuel, I think that we can talk more definitely than some of the men who have spoken before and who have mentioned their own goods.

We find in practically every industry that we enter—and we enter nearly all of them—that the gas man seems to lack nerve when it comes to getting money for an appliance. The electric people can come in and put over a sale of thousands of dollars' worth of equipment. Some will take a fan and some fittings taken from a plumber's kit and put together a blast burner system, when we have the Combustion Utilities Company, the Surface Combustion Company, the Selas Company—and others who have worked things out. But simply because of the price we go elsewhere.

Take the thermostat. You pick out of your catalog the cheapest and smallest one and put it on the job. We have seen some very bad examples, as Mr. Loebell says, for the gas men do not give the cooperation or they do not give the help to the manufacturer that they should.

In combating electricity they seem to be afraid or they do not have the knowledge. In japanning, for instance, which is particularly dangerous in operation, they do not know that electricity is equally as dangerous as gas. You can take an open flame in a japanning oven and be about equally as safe as with an electric oven. We do not recommend the open flame oven, the indirect are much

better, but there is a certain fine point which they do not seem to get.

There is one feature which we think has been amiss. The method of approach is sometimes wrong. When they approach a prospective customer they leave him with the idea that he is going to get absolute control. We know, because it is our business, and we feel them out in the approach. They are convinced they are going to get an absolute control. That is not so—they cannot get it in most cases. They can get the control but they must have the apparatus to control. In that case they sell under, what you might call, false pretenses. But the fact that gas can be so easily controlled is a feature that they should explain—whether it means hand operation of valves or automatic regulation, and that the hand operation of the valve is so much simpler than the other. We have in many cases discouraged the use of oil simply because we explain to them the difference in their oil control, the difference between our oil control and our gas control. The gas control is very simple, it is permanent, it will last for years and it does not have to be cleaned. Oil is very hard to handle, automatically or by hand.

I think all those points and instruction in them by the manufacturer of the appliance, information which he has already at hand and has learned and paid money to learn, would be good.

We have just come from Pittsburgh to show in a progress meeting what progress we have had in temperature control. In 1907 or 1908 it was just as impossible to control a temperature of 500° F. with a mechanical thermostat as it is today to control 2,000°. At that time there were available, electric instruments of very expensive design and the American Furnace Company had one. I think the price was $500. Since then, there has been development along that line, of course. In Pittsburgh last week we had, in connection with Mr. Loebell's appliances, a thermostat that controlled within five degrees at a temperature of 1700° F. all week long. Those are developments which have been made about which, we regret to say, the gas men do not know. We do not want to keep information of that sort under our hat—we are glad to distribute it. Personally, I would like to have more information as to these meetings. I have belonged to the Association and everyone seems to know something about the work that gets by me.

F. F. Cauley: We are especially favored in this meeting this afternoon by having in attendance the president of the association, Mr. R. B. Brown of Milwaukee. I am going to ask Mr. Brown if he will not favor us with a few words.

The President: You know this is one of the things that I have hoped to see come to pass for a good many years. I perhaps was one of the first, I think Mr. Cauley will agree to that, of the engineers in the gas industry that took a very active interest in the industrial field. The first company that I ever served was Newark, New Jersey,—one of the earliest companies to recognize the value of the industrial fuel field. Later on I was connected with several other companies where industrial opportunities were missing. But when I went to Milwaukee I found even a better field than we had at Newark in those days. So my interest is not of any recent acquirement.

For a good many years we had comparatively no trained engineers working

in the field and the opportunity for such a splendid section as has now been started in the national association did not present itself. But I have felt for a number of years that we did have enough of them to get together so that we could talk with people who spoke our own language. Sometimes it has not been easy to talk to our managements and associates on these industrial gas subjects. And if they did listen, sometimes they did not understand what we meant. I do not think that is so true today as it was fifteen years ago, but still it is a great thing to get among fellows speaking your language for the other fellow is as enthusiastic as you are, he knows what your difficulties are and you know what his are. So I am glad we got this latest addition to the American Gas family.

F. F. Cauley: I cannot tell you how pleased I am to hear the manufacturers talk before the gas men. It gives the manufacturer a chance to tell us the things that he has been longing to tell us. We want to encourage him. I want to have you thoroughly understand me on that. We are anxious to have you tell us some of the things that you have been wanting to tell us. With that much we will have a clear understanding. I am wondering if there is a representative of the Selas Company in the room?

J. A. Sutton (Philadelphia, Pa.): We are in between the appliance and the gas company—in other words, we represent a combustion system. Some time ago, in the years 1917-1920, the American Gas Association had a committee to work with us. At that time our appliance was a German appliance and in the hands of the alien custodian officer. Since then, of course, it has been reorganized.

Briefly, you will pardon me for explaining the system, it is a central system, automatic control by which the required air for combustion and pressure is developed. The thing that has always struck me most in our system was its comparison with electricity, which is being recognized as a competitor. The electrical people have put a lot of time and effort into controlling electricity and I believe that is why they can compete with gas. Their appliance is more expensive and their power is more expensive. But they sell the public because they can turn on the switch and the electric company insists upon the installation of the proper transformer to get the proper control for the consumer and then the consumer has no trouble. I wonder if a proper control of gas is not a good thing in the gas industry? I do not mean particularly the Selas System but any system. I think it is a good thing to look into because I do believe there is real progress being made along that line.

Speaking of electricity, I had the experience of knowing of a large bake oven manufacturer being approached by both General Electric and Westinghouse with the view of putting in a system in their oven. As a consequence, they conducted a series of tests and I am happy to state that gas came out on top. It was a long traveling oven and they had to have distribution of heat.

During the last year we have specialized particularly in the bake oven field and I will state that we have had a great deal of success and put in a great number of installations.

The invitation I received to come to this meeting states that you would like a view on what we had done and what we had in view. I think I might freely state this much—that for the future our

next step is going to be in hotel business. It devolves upon us to do the experimental work, to run the laboratory and try to develop burners and various conditions that will help the hotel trade.

We have now developed in our laboratory, but not ready for discussion, a burner which has both the advantage of the closed top and the open top range, and none of the disadvantages.

Another field we have been interested in has been the newspaper field. In that respect I would like to state that unfortunately most manufacturers of sterotype pots do not manufacture any furnace equipment that is suitable for gas. They are all now equipped for coal. Every time that we enter the field we have to reconstruct one of their furnaces. I really think some pressure should be brought to bear by the gas industry to have the manufacturers of sterotype pot furnaces, that portion underneath the pots, make up a special design; give it to an appliance concern, or to a gas company to help design, so that when the pot is put in, the gas man can go there and get his business without the arguments of "Well, we will have to redesign this, redesign that—redesign the burners, build up the grates, etc."

I can not think of anything else we have to build up in the immediate future. We are continuously bucking up against various industrial problems. We want to do the work, so far as possible, with gas companies. What we would like the gas companies to do is to give us their problems and let us talk with them and see if we cannot help them solve them. We are equipped to do that. We do that for ourselves and we would like to help you do the same thing.

F. F. Cauley: There was a remark made earlier in the meeting and I do not know whether it was a jest or not, but for fear it would be taken seriously I would like to have the atmosphere clear on it. One of the manufacturers said he had fixed up a customer but of course the gas company did not care anything about whether he made a friend for the company or not.

I want to say right here that all live gas companies today are spending a lot of money in their public relations departments to make friends, and I would like to get that clear in everyone's mind —that we are spending money to make friends with the public. All live, energetic gas companies realize the value of the customers being their friends, and anything that the manufacturer can do to cement the relations with the gas company is a real service and a live gas company will appreciate it. I do not want to let an opportunity get by without mentioning that.

I would like to ask just one question before we leave your remarks. Did I understand that you have already installed apparatus in connection with hotels or are you working on such a system?

J. A. Sutton (Philadelphia, Pa.): We have installed our apparatus but we have found the burners and equipment are not, according to our standards, entirely satisfactory for the results. We are now working to overcome the disadvantages of the open top range and the disadvantages of the closed top range.

F. F. Cauley: We would like to hear later of the success of that. Those are the things we like to hear about—the progress being made.

One of the speakers brought up a little matter regarding the japanning business and it recalled to my mind japanning

and the vitreous enamel business and the activities of the electric companies along those lines. This is splendid business for the gas company. I am wondering if some of our japanning people or oven builders are here. It is a low temperature proposition, control enters into it, and I would like very much to encourage those men in that class of business.

W. P. Duff (White Plains, N. Y.): We have done quite a lot of work in baking bread with gas, replacing the coal and the old hot air oven top. I have been working with our friends, the Selas people, lately. I think there has been more progress in that particular field in the last five years than any other field I know of. I know considerable work has been done in japanning ovens and other lines of industrial heating, but I think that in the baking of bread, cakes, pies and pastries and that sort of thing, more work has been done in replacing the coal and coke ovens with gas. At the present time, within the next week for instance, we will put in Milwaukee a new gas-fired oven which will be the first of its kind in Milwaukee.

We have ovens installed in Chicago, New York, Baltimore, Washington, Philadelphia, Pittsburgh—practically all the leading cities in the country now. We would like very much to find somebody cooperating with the gas companies to a greater extent. I have not had much experience in trying to cooperate in any other city than New York. I did not happen to call on the Consolidated officials, but I find they sell various equipment on a commission basis. Their salesmen all work on commission. They go out to interview a baker, we will say, and talk application of gas and finish by selling some sort of a gas burner. I do not think any gas company is in a position to sell such a job as ours because it has to be engineered for the conditions. We must know something of a man's requirements.

A great many cities have the A & P Bakeries, and practically all the A & P ovens are traveling gas ovens, able to produce a bread of uniform quality. Practically all of the Ward plants have the same type equipment, one of the Cushman Bakeries and a great many United Bakeries—a chain of some 50 bakeries throughout the country. It is a big field and a constant load, not a load like house heating, and one oven with gas-fired equipment will consume as much gas as fifty house-heating jobs.

We would like to cooperate with the gas companies if the gas companies will tell us how to do it. We feel it is something new and it is not anything that has been hashed over. We are turning over coal-fired ovens to gas and we have to find some way to cooperate with the gas companies in the different sections. We have practically placed new installations in every large city in the United States without any help from anybody and the local gas officials know about the installation. There seems to be a much greater field than ever before in that line. There is more bread baked in bakeries now than in homes, although about 50% of the bread is still baked in homes, 50% of the flour used is in home baking, and more bread is used—therefore, more opportunity for gas-fired ovens.

F. F. Cauley: I would like to say, gentlemen, that I feel it is one of our real new problems in the gas business. An equipment which is securing business that has been in coal for years, and that we are now taking on without any difficulty whatever, is really satisfac-

tory, and I am sure every gas man here would be very deeply interested in this proposition.

There is just one other thing I want to ask about. I wonder if there is any manufacturer in the room who manufactures enameling furnaces? I have referred to vitreous enameling.

H. O. Loebell (New York, N. Y.): We manufacture a furnace for vitreous enameling. I represent the Combustion Utilities Corporation. I suppose you think I am advertising that company. You have it right—I am. We have been using recuperator furnaces for vitreous enamel with marked success. I believe that business belongs to the gas company. There is no reason why every vitreous enameling plant located in such a place where it can be given service, should not be on your lines. If any of you gentlemen are interested in it right now I think you can get all the information at the Combustion Utilities booth. It is a fine business and it is ready for you.

I think the Combustion Utilities Corporation has been successful in transforming some of the standard type furnaces by using their equipment. Some people have made an attempt to do that without utilizing the advantages of intensive heat for recuperation and have not done so well. It depends a great deal on the size and type of plant as to what equipment is best. I know that regardless of the size and type of the plant the gas man has equipment available and if you will go to the proper manufacturer he will get the proper information to get the business.

F. F. Cauley: I am particularly interested in the subject because the electrical people are intensively active in this work. They recognize it is a beautiful load factor and they make considerable of their temperature control and we are assured by people in this room today who represent the gas control that it does equally as well. It is one of the things that we should be up on our toes on.

Anyone who visited the American Steel Treaters Society last week in Pittsburgh, or attended the American Steel Treaters Society convention will realize that in work of this kind the gas man must give it his attention. That is why I brought it up here.

E. G. de Coriolis (Boston, Mass.): On this question of vitreous enamel, quite a number of the gas range manufacturers use a large amount of enameling on their gas ranges. I was told that numerous steps have been made there to change over the furnaces from coal to gas and that such attempts have been absolutely unsuccessful and that the manufacturers had thrown up the thing in disgust. There is no doubt but what anybody able today to convert coal-fired vitreous enameling ovens to gas has a decided field at the present moment.

C. C. Krausse (Baltimore, Md.): You cannot convert a coal-fired oven to gas and hold it, but you can rebuild an oven, design it for gas on vitreous enamel and hold the business. In Baltimore we are holding every bit of the business we have on vitreous enamel. We started in 1916. Due to the low price of the oil one particular manufacturer started an experiment.

Fortunately, or unfortunately, a year ago he was burned down and it gave us a decided advantage when he was going to another field. If the other fields were cheaper, he had to buy new equipment. In his old plant he had the equipment and the oil or other fuels would have

to be figured at fixed prices. Today we have his plant signed up for a gas demand of 25,000 cubic feet an hour. No oil in the place and everything is done with gas.

Another plant we did over was on the enameling of sanitary ware. This plant was using soft coal at $6.00 a ton. On a B.t.u. basis and the price of coal and gas, there was a six to ten ratio on coal against gas. We installed the proper burners and we are competing on a direct ratio with the cost of coal and cost of gas, increasing the output and saving the man $30.00 a day per furnace on the fixed charges and other things.

F. F. Cauley: There may be some other manufacturers that we have not called. It was not really my intention to call them—I would rather have had them speak without being called, but I started that way thinking it would give them an opportunity to present their difficulties to us.

This summer I had the privilege of touring Europe, investigating the gas business, particularly the utilization side of it, and I was attracted by the close cooperation between the manufacturer of industrial equipment and the British Commercial Gas Association. I will not say that that is the cause of so much industrial gas being used for industrial purposes, but I believe it helps. When I found that cities like Birmingham and Sheffield and Glasgow in Scotland had a load, 45 per cent of which was industrial, evidently there was some concentrated work and cooperation. I believe that it will be to our mutual advantage if in the coming year we have a closer cooperation between the manufacturers and the gas men. Let us recognize some of the things that Mr. Loebell has asked for today.

In the electric companies we have the great General Electric, Westinghouse and the big companies to put out electrical equipment. I believe the gas man, and especially the industrial gas man, should pay a good deal of attention to the industrial appliance man and recognize him and not be frightened when he tells us that an appliance is going to cost $2,000 or $3,000, if he has the article. Anybody in the room who has paid any attention to the sale of industrial electrical equipment knows the prices they demand. They do not spare any expense but they sell it. I want to encourage the industrial appliance manufacturers to make the best appliances that they can make, and I want to ask the gas man, and particularly the men in the industrial end of our business, to recognize that fact and not be afraid to ask a proper price for the appliance.

(Mr. E. J. Stephany resumes the chair.)

The Chairman: I am sure the officers and organizers of this section have been very much gratified by the attendance. I want to thank the men who acted on our various committees, the men who prepared and read papers, and the men who took part in our discussions and the men who attended our sessions. I am sure that only by real cooperation can we reach the goal we have set for ourselves. I want to add that every man here when he is asked for information by any committe should respond to it. There has been some difficulty in getting information; committees have sent out questionnaires and have had few replies. If we will work together we can make the Industrial Gas Section better and our own business much better.

FINAL ADJOURNMENT.

(The following paper, "How to Get Industrial Gas Business" was delivered for the Industrial Gas Section at the joint meeting of the Commercial Section and the Industrial Gas Section.)

HOW TO GET INDUSTRIAL GAS BUSINESS

Ernest G. deCoriolis, Industrial Engineer, The Eastern Service Company, Boston, Mass.

Some twenty years ago a class of freshmen was assembled at a lecture in chemistry during which the professor was demonstrating by experiment the production of some complex and odoriferous compound. The atmosphere soon became unbearable and the professor requested that some one go down to the basement and start up the electrically driven ventilating fan. Not one man in that class of over a hundred volunteered. Remember this took place just a little over twenty years ago. Today I venture to say that any boy of high school age would have no hesitation in starting up such a simple piece of equipment as a motor-driven fan.

But in those early days it was not quite so simple. You had to go over to the engine room and apprise the old engineer that you were about to set in motion a mysterious contraption over at the chemical laboratory. It became his job then to throw in his switches, stand by the little D.C. generator and, as soon as the motor began to pull on the line, keep moving his brushes over the commutator until both motor and dynamo were up to speed and the old carbon filament lamp on the wall told him the voltage was just about right.

What tremendous progress in this brief span of years. Today, in this same laboratory, when the professor desires additional ventilation, he merely pushes a button at his side and a light shows him that somewhere in the basement the distant control switches have gone into action and started up the fan. The engineer responsible for generating the actuating current is a college graduate, sitting many miles away in his office studying efficiency charts and diagrams of load factors. For in this lies the mainspring of this great achievement of the electrical industry.

The men in charge early realized that progress was impossible unless the load could be reasonably distributed. Never could it develop if the load was to be restricted to a few peak hours of lighting in the evening and a still shorter period in the morning. Something must be done to fill in the gap, at least during the hours of daylight, and that something was necessarily a power load. There lay a virgin field to be invaded and conquered.

The John Jones Manufacturing Co., manufacturers of light galvanized hardware, had their own power plant con-

sisting of a steam engine and two boilers. The Central Power Company went after the business and for the past ten years the John Jones Co. have been buying all their power from them and in steadily increasing quantities. And numerous other manufacturing plants in every town and city have in the same way been induced by their local power company to scrap their old steam engines and purchase all their power requirements from the central electric plant. How did the electric companies do it? How did the automobile industry increase its production a thousand per cent in a decade? How do you yourselves, gentlemen, and I am now addressing more particularly those of you who have charge of the commercial end of the industry, how do you account for the large increase in the use of gas stoves, water heaters, radiant fires and other domestic gas appliances during the past ten years?

The electric company became convinced that it had a highly desirable commodity to sell to individual power users and it went out and sold it.

The automobile manufacturers became convinced that they had overcome the early mechanical difficulties so that all women could now operate a car. They went out and sold automobiles to them.

And you became convinced that you could show people how to cook better with gas. You advertised the fact, you enlarged your show rooms. You put men out to canvass the town and you sold gas for cooking. And I know you will not rest satisfied until the last coal range in your town has been carted away by the junk dealer or has taken its place in the local museum alongside the mournful sadiron.

Now I am supposed to tell you how to get industrial gas business. There are many men in this audience who could tell you of dozens and hundreds of instances where they have substituted gas for other fuels in industry and are doing the job better than it was ever done before. Even more so. They will tell you of cases where some particular industrial operation could not have been performed were it not for the availability of gas. But if I make bold to sum up their experience in a few words, if I presume to tell you how they encompassed many notable achievements in the application of gas to industrial problems, I will say this: they became convinced that if it were done with heat, it could be done better with gas, and they went out and sold it.

The slogan to them became a real article of faith but they realized full well that unless they could make the prospective consumer see it in the same light, their efforts would be in vain. In other words, they knew they had a big selling job on their hands requiring salesmanship of the highest order, for what is the essence of selling but causing the other party to believe as you do? I cannot emphasize this fact too strongly and I know you will respond to it, for I am addressing a gathering of salesmen to whom rightly belongs the job of selling industrial gas. And I say it with a purpose, for in the minds of some it is looked upon as an engineering proposition to be handled by the plant engineer as something quite apart.

I have the highest regard for the plant engineer. He is the one who has made it possible for us to go to industry and offer a fuel unsurpassed by any other in quality, flexibility, dependability and uniformity. By all means let us call on his assistance, more particularly in the smaller companies where very often he

is the only technically trained man, to figure out for us a heat balance, a power curve or a steam load. But I repeat it, gentlemen, this is a salesman's job. Leave it to the plant engineer and he will probably wait for the industrial problem to come to him. And he will keep on waiting while the oil companies are combing his territory every week with keen salesmen intent on selling oil wherever heat is applied, and the big electric equipment concerns install electric units at twice the operating cost of gas.

I will not enter here into a discussion as to the advisability or desirability of going after the industrial load. This is a matter which really concerns the management of the utility company and is scheduled for able handling and presentation later in the program of this convention. I shall merely assume that most, if not all, the companies here represented want to secure all the industrial business they can and the question with them is how to go about to achieve this end. And I shall also assume that by now every man here present is thoroughly sold on the value of his commodity and realizes that it is his job to go and sell it to others.

His first problem, quite evidently, is to locate his prospect, not wait for the prospect to locate him. Like in every selling campaign, a list must be compiled of all the potential users of industrial gas within the compass of the distributing system. The officials of this Association have already supplied you with information as to the type of operations where gas can be used and this will soon be supplemented by a comprehensive booklet in course of preparation by the new Industrial Gas Section. I will not take up your time in discussing the smaller and more obvious gas applications, for I assume that you have all successfully sold candy pots, batch warmers, restaurant ranges, cabinet baking ovens, and small boilers to tailor shops, creameries, hat shops, etc. But what about the John Jones Manufacturing Co., hardware manufacturers, and for the past ten years a good customer of the local electric light company? Have you familiarized yourselves with their operations? Quite probably they are not even customers of the gas company. What about calling on Mr. Jones some morning and telling him something about that wonderful commodity of yours? You may be surprised that he had never thought gas could be of any use in his establishment. He will confess that the gas range you put into his home a few years ago was a great improvement over the old cook stove and the new water heater you installed last spring is proving a great comfort these chilly October mornings when he wants a warm bath and all he has to do is to turn on the tap. And, without realizing it, the thought is already entering his mind that if gas can prove so valuable in his home it might very well have some useful applications in his factory.

Possibly Mr. Jones will be busy that morning and will not have very much time to give you. But he will doubtless invite you to drop in again and, as a reminder you will either leave with him or send him later a copy of the new "Industrial Gas" magazine, or any other article, pamphlet or publication that will serve to focus his attention on your commodity.

The next time you call he will naturally be more receptive. You might then suggest that you would like to see something of his operations, and he will turn you over to his superintendent or

take you through himself. This is your chance. You go in with your eyes wide open, for you have already determined that the class of hardware manufactured by Mr. Jones, being galvanized, will require hot cleaning, pickling and subsequent dipping in molten spelter. You may find very much to your surprise that he keeps a hundred horse power boiler going all summer long to supply a little steam for heating his cleaning tanks, and a long line runs to the men's locker room and another to the office to supply a little hot water.

When you get to the metal dipping room you will find a dirty place with ashes all over the floor and possibly some men waiting with a stack of work nearby because "Jim" that morning failed to start the coal fire early enough and as a result the metal is not yet sufficiently hot to dip the ware. In a corner of this same room you may find a blacksmith with his coal forge attempting to temper pieces of high speed tool steel and ruining two out of every three. Other things you might see, but this is quite enough for one day. You make mental notes of all this and on the way back to the office you decide that obviously the water-heating proposition offers a real opportunity for the introduction of gas into this plant. Besides it is something with which you are pretty familiar and can discuss with confidence. The other things can wait. By this time you will have got Mr. Jones in the frame of mind where he is willing to discuss figures with you. You can get him to tell you how much coal he burns in summer and how much he pays his fireman. If you press him too closely for details of operation he will get hazy as to exact figures but now you feel free to have a talk with the superintendent or foreman from whom you are sure to gather useful information.

The way is now open for you to do some real selling. Remember it is of the greatest importance for you to get the confidence of the man in the shop and considerable effort sometimes must be exercised in this direction. You are aiming to place a new tool in his hands. If he likes it, if you sell him on gas at the start, he will become a booster for your product and will help you in securing the consent of the management. On the other hand, if he is hostile, or even lukewarm, although you subsequently concentrate your best efforts on the head of the concern, you are likely to fail, for no executive today will foist a new device, tool or piece of equipment on the man in the shop against his opposition.

I lay emphasis on this as one of the cardinal points in selling industrial gas. Recently the head of a small newspaper, after considerable effort to get him interested, finally consented to have the gas company go over his stereotype room with a view to converting this operation from coal to gas firing. This newspaper was housed in a modern plant, a model of cleanliness. Gas had been in use for some time under the linotype pots, linotype recasting pot and steam tables. Every one connected with these operations was perfectly well satisfied. The one ton stereotype pot and casting machine was in a separate room. Two metal cans were used to hold the day's requirements of coal and a third can was for ashes. Not a particle of coal or ashes was to be found on the concrete floor which was swept clean. From the standpoint of cleanliness, gas had very little to offer. Nevertheless the foreman seemed to be favorable to gas. He had worked in another plant where gas had been used and knew all about it. Casu-

ally he referred to one instance where gas had cracked a metal pot but at the time not much attention was paid to this. A proposition was presented to the management and was promptly turned down with the statement that they preferred to leave well enough alone.

Subsequent investigation showed that the foreman was responsible for this failure. He had told the management he would be willing to use gas as it would improve things somewhat, but they must be prepared to replace the pot within a year as gas was fatal to metal pots. Right in this same town is the opposition newspaper which has been using gas for years and has not yet cracked a pot. Again, gentlemen, let me repeat: Be sure to sell the man in the shop first before you put up your final proposition to the management.

The next point of importance in getting industrial business is to secure accurate facts on which to base your proposition. When you sell a range, a water heater or some other domestic appliance you are in the true sense of the word engaged in merchandizing. Your appeal is to the senses. Your prospect generally knows very little about economics but possesses strong likes and dislikes on which you play in consummating the sale. In selling industrial gas the reverse is usually the case, and the bigger the job, larger looms up the economic and smaller dwindles its intangible value. Go into a forging shop to replace oil with gas and the factor of cleanliness is reduced to a minimum. Your case must then rest almost entirely on your ability to turn out finished forgings cheaper with gas than with oil.

The cost of revamping the oil furnace or replacing it with an entirely new gas unit will likely run into quite a sum on which interest and depreciation will have to be figured. The actual fuel bill, generally speaking, will be larger when using gas. To offset this you must be able to show increased production per furnace and per man, a reduction in spoilage, a cleaner and more uniform forging and, if possible, improved conditions around the furnace which will make the operatives more contented with their job. To do this necessitates making a careful study of operating conditions in the plant. You may have to spend several days at intervals and possibly stay on the job right around the clock for the full twenty-four hours, in case of a three-shift plant, so as to know just what you are up against in making up your estimates on gas. You will find out the number and weight of billets heated, variations in temperature, number of spoiled pieces, delays in operation and causes, labor employed in loading, unloading, handling, etc. The furnace will have to be studied to determine whether it should be revamped or scrapped. This will also afford you the opportunity to get on a friendly basis with the operatives and have them feel favorably towards the proposed change.

Right here we might just as well face a fact which I know is uppermost in the minds of at least a few of you. For years you have been devoting your energies to selling gas through the means of domestic appliances. You are thoroughly conversant with ranges and water heaters but you have with spelter tanks but the merest nodding acquaintance, and with billet forges none at all. You are quite capable of talking about the advantages of gas to the head of the concern and getting him interested to the point where he will consent to have a study made of his particular conditions. You are quite able, ready and willing to

go that far, but when it comes to looking a fiery furnace in the mouth and examining its teeth, you feel like delegating this task to some one more accustomed to taming these snorting monsters.

But where will the man come from who can step in and take hold of the industrial problem? To the large utility company, with millions of resources, the question is easy of answer. They can secure the best talent available and place under them as many men as are found necessary to adequately cover the large territory served. Not so with the smaller company that can count up to fewer than a score the number of industries encompassed by its distributing system. To what extent is it justified in adding to its staff men capable of handling industrial problems? This must be determined by local conditions. If in a town there were twenty shoe shops and no other industries, we know right away that the most capable of industrial salesmen could not increase the total sales of gas by more than one million feet or so per month, and it would take him some time to do it. An adjoining town with but one or two good metal shops, a substantial bakery and a dozen other small industries, on the other hand, would offer possibilities for many million feet per month increase and would certainly justify some concentrated effort on the part of the gas company. The question will then arise as to what grade of a man to get.

We cannot expect a young technical graduate, who has had very little, if any, experience in industry, to walk into a brass foundry and tell an experienced foundry man how to melt brass. Nor are we justified in putting him up against an experienced metallurgist who for years has specialized on heat treatment of steel. On the other hand, the potential increase in gas consumption does not warrant expenditure on a man whose knowledge and past experience would necessarily require an adequate salary. This is the hiatus which must now be filled if gas is to become the universal industrial fuel.

The electric industry was able to solve the same question largely because the application of its commodity narrowed itself to but few uses, easily handled by a young engineer, with the tremendously helpful assistance of the sales forces of the large electric equipment manufacturers. The diversified uses of gas, however, largely complicate the problem and there is no assistance forthcoming from a gigantic "General Gas Equipment and Manufacturing Corporation." Not that the existing gas appliance companies are averse or unable to render such assistance, but we cannot expect them to put much effort in the sale of a $500 piece of equipment from which the gas company, with little or no effort, will derive a revenue several times that amount the first year and for every succeeding year thereafter.

Clearly the work of initiating new business rests with the gas company. It must first survey its field to determine its possibilities and do the preliminary work of at least selling to the prospect the idea of industrial gas. This should be followed by retaining a young man, preferably technically trained but one having at least some technical knowledge, capable of going into a manufacturing plant and determining the facts involved. If the job then proves large enough, the equipment companies may be depended upon to render such technical assistance as may be necessary in effecting a sale. In any event, you will always find at Association headquarters

a considerable fund of information which you should consult freely and I know I can bespeak the willingness as well as the ability of the officials involved in giving you every possible assistance.

I have purposely left for final consideration the question of gas rates, nor do I propose to affirm what each individual company should or should not do about industrial rates. We do know that for certain processes gas is the only possible fuel and it does not take much effort to sell it at almost any price. For other processes, however, it is but one of several fuels and can be sold on a competitive basis only at such rates as are often below its manufacturing cost. Between these extreme points lies a wide field of application where the rate question plays a part varying in importance with the refinement in the use of the fuel. How far a company is justified in lowering its rates to secure a particular sale of industrial gas is largely a matter of business to be decided by the management. First, let the company decide that it wants industrial business and that it is prepared to establish such rates as will help to secure it at a profit. Then work up your proposition to the point where you can tell the management you can sell one hundred thousand or one million feet of gas to the John Jones Manufacturing Company if you can contract at such and such a rate. Rate-making, when this stage is reached, is a much simpler proposition than when contemplating prospective business at long range.

Remember, and I repeat it, yours is a salesman's job. First you must sell yourself thoroughly as to the inherent value of your commodity in industry. Then in turn you must sell the same idea to your prospect, the man in the plant no less than the executive in the office. You have been told over and over again that gas is the best, the cleanest, the most flexible, in the long run the cheapest and most ideal fuel for industry. Go out and sell it.

DISCUSSION

F. F. Cauley (Chicago, Ill.): I could not help but think how the setting was so well placed, with the gentleman delivering an industrial address and the noise of our furnace running at the entrance.

Another thing—to think that we have such a splendid body of commercial men here today. We who are in the commercial side of the gas business and who have spent a number of years in the business, have primarily gone on from day to day trying to secure new business. There have been a great many men devoting their time to strictly the domestic side of our business, and the management of the American Gas Association has very wisely found that it was necessary to inaugurate a new Industrial Gas Section for the discussion of industrial problems. This year we will open the Industrial Gas Section for that purpose.

There is just one thought that I want to give to the commercial men in this section today, following Mr. deCoriolis' address. Sometimes we say things that we do not like to say, but still they are not the truth. Sometimes we feel better if we say them, and it is better for us to get them off our chest. I feel this way, gentlemen, that in the commercial field, one of the great reasons why we have not secured a larger amount of industrial business is that the average commercial man has not been thoroughly sold on

the prospects in the industrial business. That has been the secret as to why there has not been a greater success in this line.

I would like to invite all of the commercial men who are here today and who are trying to build up the new business of their company,—now that there is a new Industrial Gas Section, there is an opportunity in all of their fields for increased industrial business,—to spend some time, at least, in the Industrial Gas Section.

I have been promoting the industrial business for a great many years, and I feel as though I have learned something about the industrial business every day. Therefore, I would like to extend to every commercial man in the room an invitation to spend some time in the next few days at the industrial meetings.

C. C. Krausse (Baltimore, Md.): About all I can say is that the last paragraph of the paper I believe hits the nail on the head, as to getting industrial business—that is, first to sell yourself the idea; next to sell the man in the shop. If you want to sell yourself the idea you will have to be thoroughly sold on the application of industrial gas. I think that is the greatest thought I can give. Very few of us, I believe, know as much about the game as we should, and I believe the formation of the Industrial Gas Section will strengthen our knowledge of the business.

J. J. Quinn (Quincy, Mass.): I just want to add a little supplementary remark to Mr. Cauley's plea for attendance at the Industrial Gas Section meetings, but I want to plead in just another way. I think that in this industrial business, up to the present time, you men who are strictly industrial men have been really somewhat to blame for the lack of increase in the business. I think a good deal of that is because you have probably held yourselves a little bit aloof from the rest, and there has been possibly a little clannish feeling there. There has always been a lot of information available at headquarters and anyone who wanted it could very easily get it.

In New England, of course, we are trying to educate the domestic men, and everyone else who is interested in the consumption of gas, in the industrial side of the business and we are trying to go at it from as practical a standpoint as we possibly can. But I think that if all the industrial men would make sort of a resolution themselves that they would discuss and pass on the various problems they have to the men in their own companies and the men at meetings such as this, who represent smaller companies, that a very great improvement in the interest in the industrial business would be shown.

The more you talk about a thing, the more enthused you become about it. That is particularly true in the automatic water heating in the past year which has had a great boom and it has been very largely due to the fact that there has been more romance talked of and spread among men and among our customers, and as a consequence, we have reaped the benefit of it in more sales.

That is just a thought, but I believe that if you can get to the hearts of the salesmen in these smaller companies and enthuse them as to the possiblities of the industrial field, interest will be stirred up and a great deal of benefit accrue.

E. G. deCoriolis (Boston, Mass.): I am gratified at the responses we have received from this audience as the result

of the things I attempted to tell you in my paper.

I have tried to stress the idea of salesmanship, and I want to emphasize that point. It is one thing to go along and sell something to an individual, but it is another thing to keep him sold. And with gas, your commodity, you are selling a man every day he is using the appliance, and not like the electrical salesman who will go in and sell a furnace and when he has sold it, he has made his profit and he is through with it.

You are selling a commodity from day to day, and therefore it behooves you, after you have put in your appliance, after the appliance is in operation, to go back at periodic intervals and see that that appliance is functioning properly and that your man is kept sold on it.

I speak of this with true knowledge, because it has recently come to my attention that one concern that had been using gas for a number of years and was apparently absolutely sold, in a very quiet way had been making inquiries as to the use of electrical appliances, and was just about to close a contract when we stepped into the field and stopped it.

Go out and sell industrial gas, and keep selling it right along. And that is the only way in which you will increase this very desirable business for your company.

MINUTES OF THE MANUFACTURERS' SECTION

MANUFACTURERS' SESSION

Monday Afternoon, October 15, 1923

The session of the Manufacturers' Section was called to order by the Chairman, Mr. F. A. Lemke, the attendance being approximately 100 members and guests.

(During the reading of the Chairman's Address, Mr. G. W. Parker, Vice-Chairman, assumed the Chair.)

ADDRESS OF THE CHAIRMAN

F. A. Lemke, Kalamazoo, Mich.

The customary address of your chairman is, as usual, a brief review of the past year.

The year now ended has been one of excellent progress for this Manufacturers' Section. We now have a membership of 270, as compared with 246 last year. There still are many eligible prospects yet to be interested in becoming members of this Section.

No meetings of this Section have been held during the year. There has seemed to be nothing for discussion at any time during the year of sufficient importance to justify the very large expense of time and money that getting the Section together as a body would represent.

Committee meetings, with the aid of the work of the very active headquarters staff, have adequately handled all matters needing attention from time to time. In that connection, I wish to express my appreciation of the careful attention given the affairs of this Manufacturers Section by our secretary, Mr. C. W. Berghorn.

During the present year, an Industrial Gas Section of the American Gas Association has been formed, that promises to be a strong active Section. At the present time it has in the course of preparation six booklets bearing the following titles:

Hotel and Restaurant Uses
Large Volume Water Heating
Wholesale Baking
Steam Boilers
House Heating
Combustion

At this particular meeting, we have the greatest exhibition ever held in connection with the gas industry; it covers 27,500 square feet of display space, as compared with 19,000 square feet last year. There are 160 exhibits as compared with 135 last year, which clearly shows a splendidly increased interest in both the Association and the industry, and

an optimistic outlook on business prospects.

This present annual meeting and exhibition has been extensively advertised by member manufacturers. Further than that, this convention and show has been well advertised by many trade journals and by mail to plumbers, architects, heating engineers, hardware and furniture dealers, in all the country east of the Mississippi River. It is hoped that many members of these more or less allied trades will accept the invitation to come to inspect the greatest display of gas appliances ever held up to this time.

It has been the policy of the other Sections of the American Gas Association to ask from and to give to this Section, co-operation of general advantage. Your Section has been represented on several committees of other Sections. One such committee of some importance is the Plumbers' Co-operation Committee of the Commercial Section. That Committee has as its Chairman, Mr. Frank H. Knapp of this Section. In the month of June, Mr. Knapp, representing the Association, addressed the Annual Convention of the great National Master Plumbers Association, which also met at Atlantic City.

The Gas Sales Stimulation Bulletins, issued by the Commercial Section this year, have been wonderfully good; but I wonder if they have fully received the deserved support of all appliance members of this Section. They should have such support that encouragement for their continuance may exist.

The Association Monthly is another opportunity that does not seem to be as usefully regarded by membership of our Section as it might be. Supply news and items of interest for use in it. Reading it is not enough. The suggestion is made that the Chairman of each of the ten Divisions of this Section furnish one paper during the year for use in the Association Monthly. Observing this suggestion would mean that each of the various interests represented by this Section would have the benefit during the year of at least one good strong article in the Association Monthly.

From time to time the suggestion has been made that there should be a large amount of co-operative advertising of gas and gas appliances in national magazines to further educate and convert the public. This subject is one of such possibilities as to deserve serious consideration. Perhaps it would be difficult right now to raise a sufficient amount of money to do such advertising in a worthwile way, possibly, though, a plan could be evolved for presentation to the Executive Committee of the American Gas Association that would be so attractive in its possibilities as to bring approval. In time, no doubt, adequate provision for such work will exist, through the setting aside by each gas company of some fraction of a cent for each thousand cubic feet of gas sold.

Your chairman has but one recommendation to make; it is of some importance to the Association, and especially so to the members of this Manufacturers Section.

An increasing number of gas properties are in the control of organizations that are mainly electric business in their general interest. We find, as a result, an increasing number of gas properties in charge of men, who, by education, experience, and tradition are electric men before they are gas men; accordingly, they are inclined to minimize the importance and usefulness of gas and to

promote gas and gas appliances only in a comparatively modest way.

The recommendation offered is, therefore, that the American Gas Association, this Section of the Association, and each member of this Section, make every reasonable possible effort to post such men that gas and electricity are substantially non-competitive; that for power purposes gas does not compete with electricity; that where gas is available, "If it is done with Heat you can do it Better with Gas," and, therefore, gas and gas appliances should have the same active, effective, constant, persistent promotion as is given to electricity and electric appliances.

REPORT OF THE NOMINATING COMMITTEE

The Secretary presented the following report of the Nominating Committee: For Chairman, G. W. Parker, St. Louis, Mo.; For Vice-Chairman, E. E. Basquin, New York, N. Y.

(Upon motion duly seconded and carried, the report of the Nominating Committee was accepted and the Secretary, as instructed, thereupon cast a unanimous ballot for the election of the officers as nominated.)

On invitation of the chairman they responded as follows:

George W. Parker (St. Louis, Mo.): This has taken me entirely by surprise. I appreciate the great honor you have conferred upon me and I will do everything I possibly can to carry on the work.

E. E. Basquin (New York, N. Y.): It gives me great pleasure to accept this office. This is really the valedictory of the old officers. However, the new officers have got to learn their duties, and I feel that the best way for me to make a good impression is to sit down.

(The Report of the Committee on Standardization of Gas Appliance Specifications was presented by its chairman, Mr. W. T. Rasch, New York, N. Y. This report will be found in the Minutes of the General Sessions on page 231.)

The Chairman: We have just had the pleasure of a call from the president of the association, Mr. R. B. Brown. Perhaps he would like to say a word.

The President: I just want to say a word of appreciation for the wonderful and absolutely unprecedented show you have put on. I never believed that anything like that could be done.

I cannot tell you anything about your business, because I do not know much about it, but I will say that with that show you have earned the grateful appreciation of the Association, and I wish to thank you for it.

The next order of business was the presentation of a paper, "Container Investigations at the Forest Products Laboratory."

CONTAINER INVESTIGATIONS AT THE FOREST PRODUCTS LABORATORY

C. A. Plaskett, U. S. Department of Agriculture, Forest Products Laboratory, Madison, Wis.

Every manufacturer and shipper realizes that much grief and a large economic waste would be eliminated if his goods were delivered to his customers in the same condition that they left the factory. How this can be accomplished without excessive packing costs is the problem which confronts practically every manufacturer throughout the country.

His product may be ideal and the time ripe to enjoy increased sales at fair prices, but because his goods arrive at destination in bad order it is difficult at times to retain even his old customers. Delivery of goods in proper condition will do much to create and stimulate consumer demand, while goods delivered in bad order has the reverse effect.

The railroads complain of the large loss and damage claims which they have been compelled to pay during the past few years. In 1921 their loss and damage claims on freight amounted to $96,730,376. These claims were so startling that the railroads decided to investigate the causes. They found that there were many causes contributing to these losses, a considerable portion of which was attributable to rough handling of freight at transfer points. They discovered that rough handling of cars, particularly in yards, was deserving of special attention, not only by reason of the excessive claim expenditures with that assigned cause, but also because of the damage to the equipment. As a result, they have been carrying on a vigorous campaign to educate their employees in the proper handling of cars and freight. This campaign, which has necessarily cost the railroads considerable effort and money, has produced remarkable results.

The loss and damage claims for 1922 were reduced to about half what they were a year previous when this campaign was started. On stoves, furnaces, radiators, etc., the claims were reduced from $902,904 in 1921 to $555,263 in 1922, a reduction of 38.5 per cent. This is proof positive that the railroads are expending considerable effort to overcome the obstacles of delivering goods in a satisfactory manner. But the railroads cannot do all. Even with the most careful handling consistent with efficient transportation, the goods must be packed to withstand reasonable hazards. Every manufacturer realizes that for the shipment of goods poorly packed which involve a big risk of loss or damage, the railroads must be protected with high freight rates. Freight claims, therefore, are an economic waste that we all want to eliminate.

It is the duty of every manufacturer to pack his goods so that they will ar-

rive in a satisfactory manner, but he should not be called upon to spend more money on packing than is necessary for safe delivery.

In their campaign, the railroads have endeavored to acquaint the shippers with the better methods of packing, but few shippers seem to realize the big possibilities of proper packing aside from reduced freight claims and safe delivery. Proper packing is a growing advertising medium which will yield results in proportion as it is scientifically worked. Contrary to the general belief that better packing means an increase in distribution costs, many manufacturers have discovered that it is possible to improve their methods of packing and at the same time effect a substantial saving in the costs. This has been accomplished by their best men giving special attention to the problems involved in packing their particular products.

In the past ten years, manufacturers and shippers have been gradually awakened to the advantages of proper packing, and a great deal of information is now available on this subject. The agitation of scientific packing has been centered very largely around the work of the Forest Products Laboratory. This work was started about thirteen years ago when its importance was not generally recognized. In order that you may better appreciate the value of the information accumulated on scientific packing, I will give a brief sketch of the whole work of the Forest Products Laboratory.

The primary purpose of this government research institution, which is maintained by the Forest Service of the United States Department of Agriculture at Madison, Wis., is the conservation of American forests by developing the most complete utilization of the trees, the best possible utilization of the products and the most economical methods of converting the trees into finished products. It is because of the big possibilities of conserving the forests by developing better shipping containers with less lumber, that the laboratory has devoted so much attention to container design. (Statistics show that about 1/6 of the lumber cut each year is used for boxes and crates.)

The work of the laboratory, which consists chiefly of fundamental research, dealing with wood in most of its properties and uses, is divided among seven technical sections. Although the work in each of these sections deals with different studies of wood and its uses, the results obtained are in some ways fundamental to the study of shipping containers. For instance, information on the suitability and use of various woods for pulp, paper and special products, as obtained by the Section of Pulp and Paper, is of value in the study of solid fibre and corrugated fibre boxes. Information on the physical structure of wood furnished by the Section of Timber Physics is of value in the study of all wooden containers. The Section of Wood Preservation furnishes information on preservative treatment of wood, on glues and problems connected with their use, painting and varnishing, waterproofing, and the finishing of wood. Closely allied with this work is that of the Section of Pathology which deals with molds and wood-destroying fungi. The chemical properties and uses of wood are studied by the Section of Derived Products. Close touch is kept on the equipment and practice of all wood-producing and consuming industries by the Section of Industrial Investigations.

Problems connected with shipping containers are studied in the Section of Timber Mechanics. This section is concerned chiefly with the study of the strength of wood, the design and strength of articles constructed of wood, and the factors which influence their strength. The large amount of data accumulated in this section on the strength properties of wood fits it especially to carry on investigations on the design of shipping containers and other built-up constructions.

These data have been obtained largely from tests on the physical and mechanical properties of more than 150 native species, including hundreds of tests on timbers of structural sizes. In studying wooden joints thousands of tests have been made on the holding power of nails, screws, bolts and other fastenings.

The study of shipping containers, however, has not been lacking from the practical or commercial viewpoint. In the commercial application of such data a detailed knowledge of the nature and causes of container failures is necessary. Therefore, at the beginning of this work, studies were made at various railroad centers and other shipping and receiving points. While these studies revealed the methods of handling and the nature of the failures, it was found that after goods have been shipped various distances and arrive in a damaged condition it is practically impossible to determine the exact causes of the failures or the best method of preventing such failures. To overcome this uncertainty and better to study the design of containers, the laboratory has endeavored to develop testing equipment and methods of testing which produce by known methods of handling, loading, etc., the same kind of failures as are commonly observed in transportation.

This work has resulted in the development of a great deal of special equipment as well as standard methods of testing. The first tests which were made on packing boxes consisted in applying a load along the diagonal of the box, thus producing very slowly many stresses which occur when a box is dropped on one of its corners. The load was measured at predetermined increments of increased deflection, and notes were made of the initial and subsequent failures. Similar tests are made by applying the load on the edge, or face of the box. Tests are made also by dropping the package in different ways from various heights. Other tests are made with a vibrating machine which simulates the swaying or weaving of a moving freight car and the starting and stopping of a train. These tests show the relative strength of the containers when subjected to stresses which are distributed more or less through them, but they do not show the ability of a container to resist local fracture caused by one box falling cornerwise on top of another.

In an effort to devise a single method of testing which would subject the package to a greater variety of transportation hazards, the revolving hexagonal drum testing machine was developed. In this drum are arranged a series of hazards which, as the drum revolves, cause the package to roll and tumble in ways that result in stresses, shocks, and rough handling similar to those of actual transportation. On one face of the drum is a projection upon which the package falls, thus simulating a box dropping cornerwise upon another. For this test the container is loaded with its contents or a substitute which produces the same effect. Various other methods of testing are also employed. With such tests as are made at the laboratory the package

is watched, the development of the failures traced, and improvements made to prevent such failures. Besides being more certain laboratory tests are far cheaper than trial shipments.

Although the data accumulated in conjunction with the development of these machines was largely fundamental, the laboratory maintained that no research work should be considered complete until its commercial practicability was established. Therefore, special efforts were made to keep the public in touch with the work which was being done, but it was not until after the outbreak of the war that the importance of the work was generally realized. At this time the laboratory was called upon to assist the War Department in the preparation of general specifications for overseas containers and to test containers for the purpose of redesigning them along economical lines. To handle this work a unit of the Section of Timber Mechanics was devoted exclusively to the study of shipping containers and methods of packing.

During this time work consisted almost entirely of applying fundamental data in the development of containers for export shipment. At the close of the war efforts were made to revert to the study of fundamentals of container design. By this time, however, the value of the work done for the War Department had become so generally known that many requests were received to assist shippers and manufacturers with their particular packing problems. These requests are so numerous that the laboratory is able to handle but a limited number of them in conjunction with the fundamental studies. The laboratory is not provided with funds to cover the cost of specialized commercial problems. This work is done on a co-operative basis whereby the co-operator pays the actual cost of making the investigation. A large number of manufacturers have taken advantage of this service and a wide variety of containers and commodities have been sent to the laboratory to be studied.

In nearly every box or crate sent to the laboratory for testing, less lumber might have been used and the strength of the container increased by a redesign. The redesigned containers usually effect a considerable saving in weight and shipping space, with a resultant decrease in freight costs. The ultimate criterion as to the perfection of any container is the condition of the contents at destination and the cost involved in making and shipping the package. After the tests have been completed, containers must be watched in service in order to determine whether or not the laboratory tests have faithfully reproduced the conditions of transportation.

In our study on the crating of furniture and other products requiring similar protection it was found that weaving and skewing of the crates during transportation are responsible to a large extent for racking the joints and breaking the legs and other projecting parts. It was shown through tests that these injuries can be eliminated to a large extent by the proper use of diagonal braces, which are very effective in producing a rigid crate.

The original crates which were constructed with several parallel slats appeared to be very strong, partly because of the amount of lumber used. This construction, however, is very weak in resistance to weaving and skewing. To produce rigidity some kind of bracing is necessary. It has been found that diagonal braces are the most efficient means

of producing rigidity. In fact, unless proper diagonal bracing is used it is practically impossible to build a crate, without excessive lumber and labor, which will not weave or skew during transportation. Diagonal braces on four sides produce a crate which is rigid in two directions, but it is not so rigid in the third direction. Neither does solid sheathing on all faces make a crate so rigid as diagonal bracing, except perhaps sheathing which is made of wide boards with tighter joints than can usually be obtained. There is a possibility then of the boards shrinking and opening up in the joints. To produce a thoroughly rigid crate, diagonal braces should be used on each of the six faces.

The frame members, that is, the foundation or skeleton to which all other parts are fastened directly or indirectly, and the method of fastening these members together, are of utmost importance. Care should be exercised to have these members made of good sound material. The 3-way corner construction which is now being used quite extensively is a very satisfactory method of joining the corner members of a crate, but this construction alone does not produce a crate which will remain rigid during transportation. This construction reenforced with a single diagonal brace on each of the six sides, however, has been found to produce a crate with maximum rigidity for a minimum amount of lumber.

The method of constructing a crate best suited to a given product depends upon the nature of that product and the kind of protection needed. It is needless to use a heavy rigid crate on a product which is itself strong enough to withstand the rough handling of transportation. Such a product would require merely a snugly fitting crate to protect it from blows and make it stack well. On the other hand, a product having but little strength requires a crate which has sufficient strength and rigidity to resist skewing and protect the contents against the hazards of transportation.

The problem of packing enameled gas ranges is quite similar to that of packing delicate pieces of furniture. The crate must be sufficiently rigid to offer proper protection to the stove. Weaving and skewing of the crate permits the shocks of transportation to be transmitted to the stove, causing the thin sheet of metal to bend and buckle and thus chip the enamel. The legs or other projecting parts may also be bent or broken.

The proper method of supporting the stove in the crate is a factor of no mean importance, but for which only very general rules can be given. Each of the many different classes of stoves offers a special problem which must be solved separately. In general, however, gas ranges should be supported in such manner that their weight is not carried by fragile or easily broken parts. Loose parts should be fastened securely in place or dismounted and packed separately within the crate.

In addition to such co-operative tests in which special packing problems are studied, the information accumulated by the laboratory is disseminated in other ways, such as correspondence, technical notes, articles in trade journals and personal conferences. A special effort is always made by the laboratory to acquaint the public with the results of its investigations and assist in the application of the data.

Liberal use of this service is made by the railroads in their campaigns for

better packing and better methods of handling freight. The reduction in loss and damage claims during the past year is accredited very largely to a more general application of the data accumulated at the laboratory, especially that pertaining to the use of metal strapping.

The educational courses of instruction on container design given at the laboratory have proved to be another very successful means of disseminating information. These courses are designed to demonstrate by actual tests the fundamental principles underlying efficient container construction. Special courses are also arranged to meet the needs of any particular group of manufacturers having similar packing problems. Each course lasts one week and is open to anyone paying the fee to cover the cost. More than 200 representatives from firms located in all parts of the United States, the Hawaiian Islands and Canada have already taken advantage of this service.

Since it has been necessary for the laboratory to confine its co-operative work to a limited number of problems which have the broadest commercial application, a number of commercial laboratories have been established and patterned after the Forest Products Laboratory. Among those laboratories which are interested in developing various types of shipping containers and methods of packing, the following may be mentioned: The Chicago Mill and Lumber Company, Chicago, Ill.; the General Electric Company, Schenectady, N. Y.; and the Container Testing Laboratories, Inc., Rockaway, N. J. There are other laboratories which are interested primarily in the study of solid fibre and corrugated fibre boxes. All of these laboratories are doing excellent work and it is the desire of the Forest Products Laboratory to co-operate with them, as well as the general public, to the fullest extent in furthering the development of better shipping containers and methods of packing.

Although a vast amount of scientific data has already been accumulated by the Forest Products Laboratory and other organizations, there are many factors influencing the economic construction of containers which have not been fully studied. Many years of intensive work will be needed to complete the study. Individuals or companies by referring their wood problems to the laboratory may obtain a statement of the tests thought necessary, and the laboratory will co-operate in their solution to the fullest extent possible with the available funds and personnel.

The next order of business was New Business.

The Chairman: I notice Mr. Taylor is in the room. I believe he had something that he wanted to bring up in connection with the Time and Place Committee.

J. D. Taylor (Baltimore, Md.): As the representative of the Manufacturers' Section on the Time and Place Committee, which will meet this evening at five o'clock, it has been suggested to me that I take up before this meeting this afternoon your wishes as to how the exhibit shall be carried on for next year.

On a recent visit to Chicago I made several inquiries, in fact, several of us have gone into the matter and talked over the possibilities. You will remember that we did expect to have a new hotel there. That hotel was to have been built to accommodate an enormous exhibit and all that sort of thing. That project has fallen through.

Now there are three propositions. We can have our headquarters at the Drake Hotel and we can get the Municipal Pier in Chicago, where they say that the meeting halls are not altogether satisfactory. Then we could curtail our exhibits and have them in a small way in the hotel. Or we can have a large exhibit in the Coliseum and invite the public and make a great big showing, as has been done in the past.

It seems to me that the Time and Place Committee, in considering this matter, should have the opinion of the manufacturers who are going to carry on the exhibit. The burden of it falls on you, and I think that you should all discuss it very clearly this afternoon so that I can carry your opinion back to the Time and Place Committee at five o'clock when we meet.

Of course, you will understand I am not saying that we are going to Chicago. I do not know. But that is the understanding. So if you will all discuss this matter freely for a few minutes, I think that I will be in a better position to make a more intelligent report at that committee meeting.

The Chairman: Mr. Taylor, have you any figures on the cost of displaying at the Coliseum?

J. D. Taylor (Baltimore, Md.): No. I have no figure for the Coliseum, but I have for the Municipal Pier—their price is ten thousand dollars and you can get it for four thousand, five hundred.

A. P. Brill (Pittsburgh, Pa.): This convention for the last two or three years has dodged the issue of going west chiefly because they have been unable to get facilities. Rather than have a convention in the west and have facilities inadequate for the requirements, if for sentimental reasons the convention should go to the west, perhaps it would be wise to consider having the convention without an exhibit. Various western cities have conventions and I think this matter has been very carefully studied by various committees and it has been proven that the facilities would be inadequate as far as hotel accommodations for the people and space for the exhibit are concerned. On the other hand, there seem to be very few cities in the country that can take care of both sides of the convention—the people and the exhibit. The needs of the people, the manufacturers as well as guests, must be taken care of in some way. If we do not have exhibit space we cannot supply those needs.

The question has been discussed of making Atlantic City a permanent place, a National Exhibition City. The bankers can go to Los Angeles one year and Atlantic City the next—they do not have anything to carry around with them—but with us, it takes a large space for the exhibit.

Eight or ten years ago we were in Atlantic City, all in the dining room of the Hotel Traymore. I am sure those of you who were there know how unpleasant the circumstances were.

So there seem to be many problems connected with this question.

W. M. Crane (New York, N. Y.): I have not given much thought to this because it was my understanding that we were going to alternate between the east and the west, and because we came here the second year I had assumed that we would be in Chicago next year. At the same time, I thought we were going to have the Municipal Pier, also the hotel.

I do feel that there is no use in attempting to give an exhibition unless we

give a good one. We need space, and there is no use in going to a hotel and locating where we have not the room, because it would be a detriment to every one if they could not get the space they wanted.

As to making Atlantic City a regular meeting place, year after year, it would suit us exactly. But I do not think that would be fair to the western people. Not only the gas companies themselves, but their employees should have the benefit of the exhibition.

A. M. Kahn (Hamilton, Ohio): Chicago has been mentioned as not having adequate facilities. The Natural Gas Association has held several very successful conventions in Cincinnati, with space, I think, adequate for a proper exhibition. Whether the hotel facilities are sufficient is a question that would have to be determined. I think there would be ample space, as far as exhibition space is concerned. Their Music Hall, in which the Natural Gas Association held their meetings four or five times, I think would prove adequate.

H. D. Schall (Detroit, Mich.): I think every phase of the subject has been considered. There are a good many things to be thought of when we are deciding as to what we are going to do.

I think this gas industry, if it is going to be national in scope, should meet in other cities besides Atlantic City.

Of course, the question of the city having adequate accommodations is the next thing. Atlantic City, of course, is ideal, but if the National Electric Light Association can go to places without exhibits—and they have a much larger association than we have—I do not see why we cannot.

This is a matter that the Time and Place Committee will have to weigh very carefully. There are places in certain cities where we could exhibit, such as the Coliseum in Chicago, which has been mentioned, and I think those places are generally known to the Time and Place Committee.

The Chairman: Is there some one here from Chicago who has exhibited at the Municipal Pier and could give us some idea as to its desirability? Mr. Daily perhaps knows something about it.

E. V. Daily (Chicago. Ill.): The pier is an ideal place to hold an exhibition of any kind. You can put four miles of exhibits there, without crowding at all. It is so arranged that you can use less than that, if desired.

I believe the main objection is the Meeting Hall at the end of the pier. It is too small for any sized meeting and there is only one such hall.

What I would like to see would be to have it at the Coliseum, if you come to Chicago, and make it a public exhibition. People are more and more every year becoming interested in "Own Your Own Home," "House Beautiful," and exhibitions of that kind. At the last one held in Chicago the place was crowded from the start to the finish, and I think the manufacturers and the gas companies would get a fine lot of publicity by having the exhibit a public one, and the Coliseum is certainly large enough to take care of us. They have been holding in Chicago right along, I believe, meetings much larger than those of the American Gas Association. There are tremendously large association meetings held there, and they certainly have hotel room for them. I do not think there would be any trouble in taking care of us.

J. D. Taylor (Baltimore, Md.): I am going back with absolutely an open mind. The point is this. We want to do the right thing. At the Municipal Pier we would be a long way from every hotel. The idea is that the Drake would be the headquarters and the pier would be given over to the exhibits—that is the only possible chance, as Mr. Daily has said. It would be impossible to hold the meetings on the pier. It has been found impracticable by several associations that have tried it.

It would be just as easy to go to the Coliseum and put on a big show, but if you do, you have got to limit the time that you show it to the public, because we are primarily showing our product, as I look at it, to the gas companies. Now, if we are going to give a public demonstration in Chicago we will be giving it for local conditions, for Chicago. I am not speaking of Chicago particularly —if we invited the public every day down to this pier to come in here and look over the gas stoves, we would be giving the exhibt for the Atlantic City Gas Company, and the same thing would follow in Philadelphia, if we were there.

We are national, we are giving the exhibit for everybody who is attending the Association convention and not for the public. If the public is admitted, it should be at a time when the gas man is thoroughly satisfied to go around and play some place else.

I have had personal experience for a number of years where the public was admitted. It is a battle—that is all there is to it. They want souvenirs. They will take the legs off the stoves, if you let them. They want something to carry away, and a large percentage of them are not interested in what you are showing. You are embarrassing the public, you are embarrassing yourself.

At the Coliseum you could hold all your meetings. If, on the other hand, our exhibits were curtailed, we could exhibit in the Drake, but we would have to have a limited display, and certainly there are none of us who want to go back to the private chamber stunt we pulled in Chicago three years ago.

C. T. Aaron (Boston, Mass.): About eight or nine months ago did not this Association take a mail vote between Atlantic City for 1923 and Chicago for 1924? And did not the Association definitely decide to go to Chicago in 1924, not only the Manufacturers' Section, but the entire Association? I believe the Association announced 1923 for Atlantic City and 1924 for Chicago.

The Chairman: I do not believe that was the case. I understand that vote was relative to 1923 and it did not commit us to anything for 1924.

J. D. Taylor (Baltimore, Md.): I do not want to be misunderstood. It is a question of what we want in the way of an exhibit if we go to Chicago.

C. T. Aaron (Boston, Mass.) I think we should have adequate space to show our merchandise. If we do not we are not doing justice to the manufacturer and not doing justice to the gas company who sends its representative there.

I do not think we want the public in. I think there are other ways of educating the public besides taking the one week which we want to devote to the gas industry. And I certainly would not favor going back to the hotel demonstration in a ten by ten space.

S. Grady (Philadelphia, Pa.): I am naturally prejudiced toward Atlantic

City. Mr. Schall said that the N. E. L. A. was a larger organization and had meetings and shows in different parts of the country. My knowledge of the N. E. L. A. is that the only place they have a show is in Atlantic City. They do have other meetings without a show.

We have a lot of national organizations, such as the Car Builders, A. E. R. A., etc., who have settled on Atlantic City as being the only logical place to have a combined exhibit and convention.

Regarding Chicago, I am sure that we do not want to go back to the bathroom again. The Municipal Pier is anything but conveniently located to the hotels. The Coliseum, I believe, is rather an expensive proposition.

I think it up to the Association to take another vote as to whether we will have the convention at Atlantic City or Chicago next year.

T. C. Clifford (East Pittsburgh, Pa.): I believe it would be disastrous to go to Chicago, or anywhere else, and hold our meetings in one building and our exhibit in another. In fact, my experience in two other associations has proven that unless you have your meeting rooms so arranged that it is necessary to pass through the exhibition rooms to go to and from them, the exhibits receive very little attention from the delegates. If we held the meetings in the Drake Hotel and had the exhibit on the Municipal Pier, it would represent a loss of money to the exhibitors because they would not receive the attention from the delegates they should. I therefore believe it would be better to hold biennial displays, with the alternate meeting in Chicago without any display.

If it is the purpose and the desire of the American Gas Association to hold the alternate meetings in the west, I think the manufacturers ought to cooperate with them to the extent of agreeing to hold a biennial display here where we have ample facilities and cooperate with them in their meetings in the west without a display.

The Chairman: That subject has been argued from time to time in the past, and I believe we are all quite thoroughly committed to the theory of having a display every year. But for the benefit of Mr. Taylor, if there is anybody opposed to that idea, will they please rise. (No one rises.) Well, I think we are all in accord with the desirability of having the display every year.

For the further benefit of Mr. Taylor, will those who prefer to have the display in the west, or elsewhere than Atlantic City, if adequate facilities can be had, please rise.

(About half of the membership rise).

J. D. Taylor (Baltimore, Md.): That would mean that if you want to have it in the same building you would have to go to the Coliseum. Then you could have your meetings all day there and the exhibit at the same time. That brings it down to a fair basis, if that is agreeable to you.

There is another thing I would like to know. If it is in the Coliseum I would like to have a positive expression from such men as Mr. Crane, Mr. Schall, and the others, as to whether they want the public in or not. I do not.

The Chairman: I believe, Mr. Taylor, if you were to hold the meeting in Chicago, it would be extremely desirable, instead of having the public excluded all the while, to have the display open to the public part of the time and have it open

part of the time to other allied trades; otherwise, the tremendous cost of display in the Coliseum would hardly be justified.

J. D. Taylor (Baltimore, Md.): I think it is all right to have the public in two or three nights at a time when the gas men do not want to come in.

Gentlemen, this is a serious question. You have got to get down to what you want to do. We have got to report on this thing. Look at the enormous exhibit we have here this year. Why, we have things there that a lot of us never heard of before in the way of appliances and in the way of adding machines, etc. But we have got to take care of those fellows because they are kindred, they belong to us, and we have to find out just exactly how we are going to do it. You manufacturers have got to support it, and you had better express yourselves now than to kick about it afterwards.

The Chairman: If anyone would care to make a definite motion, the Chair will entertain it. The matter has to be more or less flexible.

Has anyone anything else to bring up under the head of new business?

J. S. De Hart, Jr. (Newark, N. J.): The Executive Board this afternoon will have presented to them a resolution from the Commercial Section in regard to retail pricing. I think it would be of some interest to the members of the Board if the Manufacturers Section would offer a little expression of opinion as to how they feel in regard to this matter. This resolution will come up for approval by the Executive Board, and then the program is to submit it to the Manufacturers' Section. I have the resolution here. It reads:

"Whereas, the continued development of the gas business requires unceasing distribution of highest quality appliances, and such fact compels the participation of gas companies in the retail appliance business: and,

"Whereas, gas appliance manufacturers now commonly supply their wares for resale to dealers unaffiliated with gas companies, which dealers, by manipulation of retail prices on said appliances, exercise an influence on the public mind derogatory to gas interests: and,

"Whereas, the diverse character of dealers who now sell appliances and the unsympathetic relations between these dealers make for continuing and increasing price confusion, this being due to the present method employed by manufacturers in billing goods to their dealer customers, therefore;

"Resolved that the individual appliance manufacturer members of the American Gas Association be requested to independently determine what their respective products should cost the ultimate purchaser, that they place the retail price, by tag or otherwise, on each appliance, that they furnish appliances for resale to the dealer customers at retail prices, less a discount, and in this manner they protect the ultimate purchaser, uphold the reputation of their goods and make impossible the charge that gas companies are either profiteers or wish to drive independent dealers out of the appliance business;

"Resolved, further, that said manufacturer members be requested to observe the principle that a commodity is worth what it costs to produce and distribute, plus a profit, and, therefore, in naming trade discounts applicable to retail prices, they, first, give due recognition to the character of selling service performed by

each dealer and the expense incurred thereby; and, second, that trade discounts based upon the quantity purchases be collateral and in addition to the base discount;

"Resolved, lastly, that because there is daily contact between gas companies and the public to the appliance medium of gas utilization, and because a prime step to secure the permanent confidence of the public lies in fair and stabilizing policies, the Executive Board be respectfully asked to approve the important proposal contained herein, and that said Board place this matter before the Manufacturers' Section for action."

Now, the Executive Board is simply asked to approve it and then it is up to the manufacturers to approve it and follow it out as they see fit.

As a member of the Executive Board, I will be very glad, indeed, to have a little expression of opinion in regard to this resolution.

W. M. Crane (New York, N. Y.): That sounds very nice, indeed. I do not think that there is any manufacturer but would like to make his costs and then add fifty or a hundred per cent profit. But I do not see how he is going to do it, and I do not know why the gas companies come to us to establish a retail price. I know three companies not a great many miles apart, one takes 25 per cent profit, the other 30 per cent and the other 75 per cent. How are we manufacturers to determine what retail price to fix on our goods? I do not think I would care to go into that question—I have enough trouble without that. I am not in favor of that until the gas men themselves say they are satisfied with 50 per cent or 75 per cent, or whatever it may be.

S. Grady: (Philadelphia, Pa.) Mr. Crane covered the situation very thoroughly. If we can get Mr. Gas Man to agree on what percentage he has to add to his cost to give him a reasonable return, then we can fix a retail price.

We had a similar experience, right in our territory, with three or four gas companies all disagreeing as to the percentage which should be asked, and every one contended the other fellow was wrong. We consider that a family quarrel and just keep out of it.

T. C. Clifford (East Pittsburgh, Pa.): I think the Association will run across Federal Laws if they attempt to agree to establish their resale price. It can not be done, legally.

C. T. Aaron (Boston, Mass.): We print a price list which is given out to the trade and it contains a black figure which is the list, and a red figure which is the cost price. That is issued to the dealer with a suggestion that he obtain our list price, plus the cost of connecting where there are any gas or water connections to be made. That is not absolutely adhered to by the dealers, although in the majority of cases it is.

On this question, I think we had better sit tight and let the gas companies settle that.

The Chairman: I think, Mr. De Hart, that gives you a fair picture of the situation.

J. S. De Hart, Jr. (Newark, N. J.): This resolution is signed by the gas men. I take it from this discussion, that if the gas men try to put it across these men will co-operate. If it can be done. do you want it done?

H. D. Schall (Detroit, Mich.): For Mr. De Hart's information, I think it

is well to understand, especially on gas ranges, that there are probably as many gas ranges sold by people other than gas companies as by gas companies, and you would not have the control over your resale price, even if you adopted that policy.

J. D. Taylor (Baltimore, Md.) : I have been battling this thing for practically two years. I am sorry the father of the bill is not here to defend himself. I did not vote for this. I put myself on record for that on that committee. I was one of the two negatives—that it should not even be considered.

We were discussing this question last night with some gas men from the South. One of them told the story of where a party went thirty-six miles to another town and bought one of our ranges and took it back over to the other town thirty-six miles distant. He said he could get it so much cheaper at that town that he could afford to pay the drayage charges and bring it back.

I have just gotten back from the Pacific Coast. While I was there I walked in on our dealer in San Francisco, looked over his list, stock, prices, cost, etc. There was an extra column down there. It was "Sales Price." I said, "What's this?" He said, "That is the price they sell at." I said, "Do you mean to tell me you dictate to your trade the price they must get?" "Absolutely." "Do they all do it?" "Absolutely."

Well, I then went out to the Wedgewood factory. Harry Jackson took me all through it. There they hang a tag on the door of the range when it leaves the factory—"This range must be sold at such and such a price"—and that price is adhered to.

Now, that custom prevails in San Francisco, but that does not mean that it would prevail here. We would have to reorganize our entire business to carry on any such move.

I do not think we ought to consider it.

J. E. Nason (Erie, Pa.) : The cost of sending a gas range from the east to the Pacific Coast is about eight dollars. The cost of shipping a gas range from, for instance, Philadelphia to Chicago, is about three dollars. When one is doing business from the east to the west, the item of freight comes in and you would have to establish one price, for quite naturally you would have to have one price for all places, which would be difficult to do.

The Chairman: Has anyone anything else to bring up under the head of new business? If not, this concludes our program.

FINAL ADJOURNMENT

APPENDIX

Specifications presented with the report of the Committee on Standardization of Gas Appliance Specifications.

COMMITTEE ON STANDARDIZATION OF GAS APPLIANCE SPECIFICATIONS

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Geo. D. Roper .... Rockford, Ill.
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C. C. Winterstein .... Philadelphia, Pa.
P. B. Wiske .... Brooklyn, N. Y.
A. L. Palmer .... New York, N. Y.
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SUB-COMMITTEES

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Standard Code for Testing and Rating Unvented Gas-fired Steam Radiators

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Standard Code for Testing and Rating Gas-fired Steam Boilers

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W. L. Powers .... Rockford, Ill.
N. T. Sellman .... New York, N. Y.
E. J. Stephany .... Pittsburgh, Pa.

STANDARD GAS RANGE SPECIFICATIONS

American Gas Association, Inc.

Revised 1923

1. Oven Dimensions—Standard 18-Inch Ranges

Note.—All dimensions are minimum and given in the clear.

	Height	Width and Depth
Single Oven Type		A standard minimum width and depth of 18″ is recommended for all types.
Note:—Where a broiling burner is used in this type of stove, the clearance under the burner to be not less than 10″.	11-12″	
Double Oven Type		
Broiling Oven	8½″	
Baking Oven	11-12″	
Elevated Oven Type		
Where both broiling and baking ovens are above cooking top—		
Broiling Oven	5″	
Baking Oven	11-12″	
Where one oven is above and one oven below cooking top—		
Broiling Oven	8½″	
Baking Oven	11-12″	
Cabinet Type		
Broiling Oven	8½″	
Baking Oven	11-12″	

Note.—This clause does not include auxiliary ovens. It is to be understood that the dimensions shown above need not be strictly adhered to, and are only shown to indicate those which are generally preferred.

2. Sheet Iron

No parts made of sheet iron[3] to be less than No. 24 gauge[2], except rack supports and top back strip. Heavier metal should be used where specified and no galvanized iron to be used except for burner box linings, bottom parts of extreme range bottoms, burner trays, or bottoms of elevated broiling ovens when. so ordered. Wherever practicable, one pass cold rolled steel is preferred.

3. Body

Range body to be made preferably in one piece. When sectional construction is used, the number of parts to be as few as possible.

In ranges of the single and double oven type the body sheets to extend from the base to the top frame.

4. Front Frame and Top Frame

Front and top frame to be made of cast iron, angle iron or pressed steel. If made of cast iron must have a cross sectional area not less than ¼ sq. in. and with an overall depth and width of not less than ¾″ each. If made of angle iron to have a cross section of not less than ⅛ sq. in. and with no side of the angle less than ¾″. If made of stamped sheet iron to be not less than No. 18 gauge and, if channel shaped construction no side less than ¾″, and if angle shaped construction no side less than 1″.

5. Base

All band iron, angle iron or other structural steel shapes to have joints riveted or with continuous welded seams, bases to be shipped as one piece.

6. Leg Shelf

All four edges of sheet metal leg shelf to be so formed or reinforced for their full length that buckling under any conditions will be prevented. This reinforcement, preferably, to be of one-piece construction.

7. Oven Linings

Baking and broiling ovens to be furnished with linings to provide air space insulation to the ovens at sides and back.

	Band Iron to be not less than	Angle Iron to be not less than	*Sheet Iron to be not less than	Cast Iron
Cabinet ranges and elevated oven ranges without low ovens which have bases 36″ or more in length	2″x⅛″ or 1½″x3/16″	1½″x1½″x⅛″	No. 18 gauge folded so as to make edge 2″x1/10″	
Cabinet ranges and elevated oven ranges without low ovens which have bases less than 36″ in length	1½″x⅛″	1¼″x1¼″x⅛″	No. 18 gauge folded so as to make edge 1½″x1/10″	
Other types of ranges such as single and double oven ranges, including low ovens, with bases more than 24″ in length	1½″x⅛″	1¼″x1¼″x⅛″	No. 18 gauge folded so as to make edge 1½″x1/10″	
Other types of ranges with bases 24″ or less in length	1¼″x⅛″	1″x1″x⅛″	No. 18 gauge folded so as to make edge 1¼″x1/10″	One piece construction

*Corners of sheet iron construction must be reinforced with ⅛″ band iron having the full width of the edge and extending on each side at least 3″.

Where used for insulation solely there is to be not less than ¼″ dead air space. Where the back space is used for flue purposes, there is to be not less than ½″ space.

Baking oven to be furnished with a top lining, providing not less than ½″ space.

Linings to be easily removable and to be held in place without bolts.

8. Burner Box and Burner Box Lining

Burner boxes, when no linings are used (excepting cast iron burner boxes) and burner box linings, to be so treated as to effectually withstand corrosion.

Burner box lining to cover entire bottom of burner box. Sides and back to be turned up to meet top frame. In box cabinet ranges, the bottom sheet of the burner box lining is not required. Burner box lining to be easily removable for repairs.

9. Oven Tops

The outside part of the tops of ovens on elevated and cabinet types of ranges, if of sheet steel, to be not less than No. 20 gauge.

The tops of separate elevated broiling ovens to be made in two parts. The inside part directly over the broiler burners to be made of not less than No. 18 gauge steel. The outside part to be made of two pieces not less than ¼″ apart, and properly insulated (dead air space insulation preferred). If any other insulating material is used, it is not to be exposed and must be tightly enough packed to keep it from shifting and giving uneven protection. The inside sheet of the outside part to be made of No. 20 gauge sheet metal, while the outside sheet may be either cast iron or not less than No. 20 guage sheet steel. This outside part to be bolted together and handled as one piece.

When a broiling burner is placed in one oven with the baking burner, the oven top lining (the sheet immediately over the burner) should be of not less than No. 18 gauge. In those ranges where the bottom of the burner box constitutes the upper sheet of the flue space above the top lining, suitable insulation should be provided to prevent excessive heating of the bottom of the burner box. Such insulation to consist preferably of a dead air space or thick insulating material with a sheet metal lining at the top of the flue space of not less than No. 20 gauge.

In ranges of the cabinet type, where a broiling burner is placed in one oven with the baking burner, the oven top construction to be made as already specified for the tops of separate elevated broiling oven.

10. Baking Oven Bottoms

Bottoms of baking ovens to be of cast iron or sheet steel. When made of sheet steel and insulated, the bottom is to be double and the insulation is not to be exposed, and is to be so placed that it will not shift. The sheet metal to be used in the upper part of the oven bottom to be not less than No. 22 gauge, the lower sheet to be of No. 18 gauge. When not insulated but the open space between the sheets used for circulation, both sheets to be of No. 18 gauge.

11. Extreme Bottoms and Broiling Oven Bottoms

Where a separate leg base is used, extreme bottoms and broiling oven bottoms to be constructed as removable parts, and to be readily removable as one piece.

Bottoms of elevated ovens, on the elevated oven type of range when exposed to the products of combustion of top burners, to be either of cast iron or sheet steel. Where sheet metal is used it is to be so treated as to effectually withstand corrosion.

12. Rack Supports

Rack supports when made of sheet metal to be not less than No. 26 gauge and to be made of channel construction to prevent racks from tilting when partially withdrawn.

13. Flues

The flue collar to be of cast iron or if sheet steel, to be not less than No. 18 gauge. Collar for flue connection to be on the top of the range or at the rear and to be so ventilated that the placing of a vessel over the collar will not prevent the oven products from escaping. When flue is located at rear of range outlet must look up.

The outlet for flue connection on canopies to be round and of such a size as to fit a 6″ flue pipe.

The bottom of flue or flue box on which condensation from the products of combustion or vapors from cooking may collect, to be made of cast iron or No. 20 gauge sheet metal.

The products of combustion from the oven burners must be discharged directly into the flue of the range.

14. Doors

Swing doors to be hung on pins, preferably set in the door lugs when same are cast, and tops of lugs to have a smooth finish. If loose pins are used, the lower end of pin is to be split so that it may be spread to prevent accidental displacement. Door catches to be so designed that any pressure on the door from within the oven will cause it to open.

In the single oven, double oven and elevated oven types, when swing doors are used, the hinges are to be placed on the side of the range opposite to the oven burner cocks. In the cabinet type, swing doors, when used, are not to open toward the cooking top.

Drop doors, when over six inches in height, to have a spring or counterbalance. Drop doors to have a flush inside surface. It should be possible to fully observe the baking oven burner flames without opening either the baking or broiling oven doors.

15. Legs

Legs to be of such a height that there will be a clearance of not less than 2½″ between any part of range body or base and floor.

Legs to be detachable and interchangeable.

16. Oven Burner Body Plates

Oven burner body plates to be so assembled as to make a close-fitting joint with the lining and with the burners, so that there will be no loss of heat or escape of products of combustion through openings at these points.

17. Bolts

No bolts or screws to be used except those having standard stove bolt threads. Door knobs, handles and name plates to be attached by through bolts with nuts, and not by rivets.

In general, through bolts with nuts to be used throughout. When tap bolts are used to attach door linings and hinge boxes they should be sherardized.

If more than six bolts are used to attach lining, the bolts and nuts holding the knob or handle and name plate on the door to be accessible without the removal of the door lining.

No bolts smaller than 3/16″ to be used. Bolt holes in castings to be circular, and not slots.

18. Top Grates

Top surface to be raised at least 5/32″ above the level of the top frame. Edges to be gradually beveled to where they meet the main top so that a vessel will slide on or off without jar. Top grates to be interchangeable; two pieces preferred. Openings in top for grates to be as large as practical, especially from front to rear. Grates to be so constructed that they cannot be inverted.

19. End Shelves

To be of cast iron, or if of sheet steel, to be of not less than No. 18 gauge. Where two shelves are used they are to be interchangeable.

End shelves to drop into place loosely and not to be bolted.

20. Top Burners

Burners to be cored castings and not to have any loose parts. This applies to simmering as well as to other burners. The gas outlets to be drilled ports. No cone spreaders to be used. Top burners not to be bolted to their supports. No supports to be bolted to range. Supports to be interchangeable. The supports to be such as will keep the burners permanently and rigidly at even distance below the top grates. The distance between the tops of burners and the bottom of a vessel placed on the top grates to be not less than 1¼ inches, nor more than 1½ inches.

The simmering burner to be so located that its combustion will not be hindered by, nor interfere with the combustion of any other burners. The simmering burners on cabinet ranges are preferably to be located on the side of cooking top, opposite the ovens. It should not be placed on the side adjacent to the ovens.

The giant burner also on cabinet ranges is preferably to be located on the side of cooking top opposite the ovens.

21. Oven Burners

To be easily removable, not to be bolted or locked into their supports by any means, and to be so arranged that they positively cannot be inserted upside down —(this clause does not preclude the use of any temporary fastening to prevent displacement in shipping). The gas outlets to be drilled ports. Port drillings to be such as shall permit flame to travel quickly across burner when lighting.

Burners of the type now generally used in box cabinet ranges, in which the mixer tube and burner proper are separate castings, to have the joint between the two parts made up tightly and permanently and the burner to be easily removable as one piece.

The use of baking and broiling burners in one oven is not permitted unless the control of these burners is such that they cannot be operated at the same time.

22. Oven Burner Supports

Oven burner supports to be rigid construction and must hold the burner so that it sets straight and cannot be easily tilted. The support must not interfere with the burner ports. Where the oven body is made of sheet iron, the burner support must be bolted to the rack supports or oven lining. Where the oven body is made of cast iron, the burner sup-

port can be fastened to or form a part of the range body.

23. Oven Lighters

No device or method shall be used for lighting the oven burners except one that ignites these burners instantly at any working pressure and under all service conditions, and which will in no way interfere with the combustion of the oven burners.

24. Air Mixers

Air Mixers for top and oven burners to have flat faces smoothly finished, so as to prevent leakage of air, and fitted with flat-faced close fitting shutters, to be attached by 3/16″ stove bolts.

The location of the bolt heads to be such that no part of the burner cock or manifold shall prevent free access to them with the screw driver.

25. Air Shutters

Shutters of all burners to be capable of any desired adjustment and so constructed that the position can be rigidly fixed to prevent slipping

It should not be necessary to completely remove the bolts when shifting the shutters from one adjustment to another.

Lock washers, when used, should have a firm bearing on the shutters, the side bolts preferably working in slots so that the lock washers shall bear against the shutters on both sides of the slot.

Shutters to be of substantially cast or malleable iron or of not less than No. 20 gauge sheet steel, and if of sheet steel the edge to be turned over. Shutters for top burners and sheet steel shutters for oven burners to be coated with a non-corrosive metal or finish.

Shutters must make a close fit with mixer faces and when closed fully there are to be no uncovered openings.

26. Cocks

Ranges are to be equipped with cocks shown in Exhibit "D" for fixed orifice and in Exhibit "E" and Clause 5 of Performance Specifications for adjustable orifice.

In the box cabinet ranges, the handle of the oven burner cock placed in the top burner manifold in line with the top burner cocks, should be different from the handles of the top burner cocks, in order that it may be easily distinguished. Thus, a flat metal handle, preferably with the word "Oven" cast therein would be acceptable.

Likewise, the handles of separate pilot cocks should be different from those of the oven burner cocks. A round metal handle would be satisfactory for this purpose.

27. Manifolds

Manifolds to be not less than ¾″ heavy wrought iron or steel pipe, and all ends to be carefully reamed on the inside to remove the obstruction or burr caused by cutting.

Manifolds not to be constructed of bent pipe. Manifold supports to be of split type instead of solid pattern.

To be two supports for the oven manifold.

Oven manifold supports to be so designed that by removing clamps from them the manifold may be swung outward. The riser from the oven manifold to be located at the back of the range.

The entire manifold assembled to be tight and free from leaks when subjected

to a pressure of three pounds per square inch.

Cast manifolds are acceptable but when used they should have an internal cross sectional area at least equal to that of ¾″ pipe and they should be made of good grey iron.

28. Burner Trays

Burner trays under top burners to be so treated as to effectually withstand corrosion[4]; have the four edges turned up and the corners made tight; to be of ample length, breadth, and depth to catch anything spilled through the top grates; not to bind on the sides of the burner box, and to have convenient hand hold; all edges of pan and hand hold to be smooth.

29. Oven Racks and Broiling Pans

To be two oven racks of strong and durable construction. Oven racks and broiling pans to lie perfectly flat and not to bind against the rack supports either before or after the oven is heated.

30. Name and Number

Name and number to be affixed to a main part of range and to be of a permanent and distinct character, easily determined at all times.

31. Elevated Ranges

Air supply to elevated ovens to be taken in at back or sides, so as to avoid, as far as possible, the drawing in of products from the top burners. The air holes to be so staggered as to prevent the flame from being driven out through these holes by back draft and also prevent any possibility of a consumer trying to ignite the burner through these openings.

32. Cabinet Ranges

If any pipe or connection is placed below the supporting frame of the range, it is to be so placed as to be protected from injury during shipment or installation.

Notes

1. Nothing contained in this Specification shall be construed as indicating the approval by the Committee of any particular type or range

2. Unless otherwise specified, all gauges are U. S. Standard.

3. The terms steel and iron are used interchangeably throughout the Specification. Either iron or steel is considered satisfactory.

4. Sheet metal is understood to effectually withstand corrosion for the purpose of this clause of the Specification if it fulfills the requirements prescribed in the tests which appear in the Appendix of this Specification under the title "Exhibit A."

APPENDIX

Exhibit A

Sheet Metals, to be Considered Suitable for Use Under the Provisions of Clauses 8, 11 and 28 of the Accompanying Specification, Must Satisfactorily Meet the Following Requirements:

1. A piece of the metal to be tested, about 4 inches square, is first placed in an oven and brought to a temperature of 400°F. If at this temperature, and after quenching in cold water it shows no sign of softening, flaking or other deterioration, it is to be cleaned with petroleum ether, then thoroughly washed with water and dried, to remove all adhering grease and dust which might interfere with the

action of the reagent to be used, and then subjected to either of the tests described below, according to the kind of metal.

2. For Galvanized Sheet Metal the Test is as Follows:

About 10 drops of the copper sulphate solution (described in paragraph 6) are placed in the center of the test piece of metal. The solution is quickly washed off after twenty seconds. Repeat this, placing the solution on the same spot as before, and keep repeating the test until the test piece has been exposed to the action of the solution for one hundred and forty seconds. If no bright deposit of copper, which cannot be removed by washing and rubbing with a rag or piece of waste has been formed, the material is to be considered satisfactory for the purpose of this Specification.

3. For Coated or Chemically Treated Sheet Metal (excluding Painted, Japanned and Enameled Sheet Metals) the Test is as Follows:

About 20 drops of the copper sulphate solution (described in paragraph 6) are placed in the center of the test piece. After a ten-minute exposure it is quickly washed off and dried. If, after repeating this operation three times no copper deposit is noticeable, the material is to be considered satisfactory for the purpose of this Specification.

4. For Painted and Japanned Sheet Metal the Test is as Follows:

A sample of the coated metal is dipped for a few seconds in hot lard, having a temperature of 400° F., and the sample then wiped clean. If none of the coating is removed, the material is to be considered satisfactory for the purpose of this Specification.

5. For Enameled Sheet Metals the Test is as Follows:

A sample of the coated metal is dipped in a 5% solution of Soda Hydrate Caustic, having a temperature of 200°, and then left immersed for thirty minutes. If the coating is unaffected, the material is to be considered satisfactory for the purpose of this Specification.

6. Copper Sulphate Solution

The copper sulphate solution is prepared by dissolving 36 parts by weight of commercial copper sulphate in 100 parts by weight of water. To this solution an excess of chemically pure cupric oxide is added, and after being shaken and allowed to stand for ten hours, the undissolved excess of cupric oxide is filtered off, and the remaining solution is used as described above.

NAMES FOR STOVE PARTS

Burner Tray—supplanting Dirt Tray, Dust Pan, Scavenger Pan, Drip Pan, etc.

Broiler Pan—the pan in the broiler.

High Shelf—the complete high shelf as ordinarily used on a Cabinet Range.

Canopy Shelf—the canopy and shelf that is attached to the range, and supplanting such names as Hood, Small Canopy, etc.

End Shelf—the shelf at the end of the top frame.

Leg Shelf—the shelf located between the legs of a Cabinet Range supplanting "Low Shelf" and "Leg Pan."

Enamel Splasher—The word "Splasher" is not to be used except in the case of Enamel Splasher only. Some manufacturers have called what we term the "High Shelf" a "Black Splasher."

Cast Iron Parts

Top Grate—supplanting "Top Grid," "Burner Grid," etc.

Top Burners—Giant, Regular Front, Back R or L, Simmering.

Top Burner Support—Different manufacturers use different styles of support but we favor in all cases calling it the "Top Burner Support."

Top Burner Support Holder.

Oven Burner Support.

Oven Burner.

Oven Lighter — supplanting "Pilot Light," "Open Door Oven Burner Lighter," etc.

Front Frame—the main frame of the gas range. In cases where this front frame is in two pieces it shall be designated as "Upper Front Frame," and "Lower Front Frame."

Top Frame—the main frame of the cooking top.

Base—the cast iron base of the range. This name "Base" will apply whether band iron, angle iron, or sheet steel base is used.

Leg—supplanting "Foot," etc.

Oven Door Frame—frame of the oven door itself.

Broiler Door Frame—frame of the broiler door itself.

Flue Collar—supplanting "Pipe Collar," etc.

Hinge Box—Right or Left—Oven or Broiler, supplanting "Hinge Cap," "Journal Box," etc.

Door Springs—Right or Left—Oven or Broiler.

Name Plate.

Door Catch.

Top Frame Support—Some people have called this part "Right or Left Stands," and some have called it "Burner Box Corners."

Oven Burner Body Plate—the plate on the outside of the body of the range through which the oven burners project. This has sometimes been known as "Manifold Plate," "Mixer Plate," "Dial Plate," etc.

Front—Gas supply pipe for cooking top burners.

Manifold Oven—Gas supply pipe for oven burners.

Riser—Gas supply upright pipe.

Manifold Support—Front, Oven.

Manifold Support Clamp — Front, Oven.

Cocks—Fixed Orifice, Adjustable.

Air Shutter—supplanting Mixer Cap.

Oven Rack.

Broiler Rack.

Broiler Pan Rack.

Sheet Iron Parts

Oven Bottom.

Oven Right Side Lining.

Oven Left Side Lining.

Oven Back Lining.

Oven Top Lining.

Broiler Right Side Lining.

Broiler Left Side Lining.

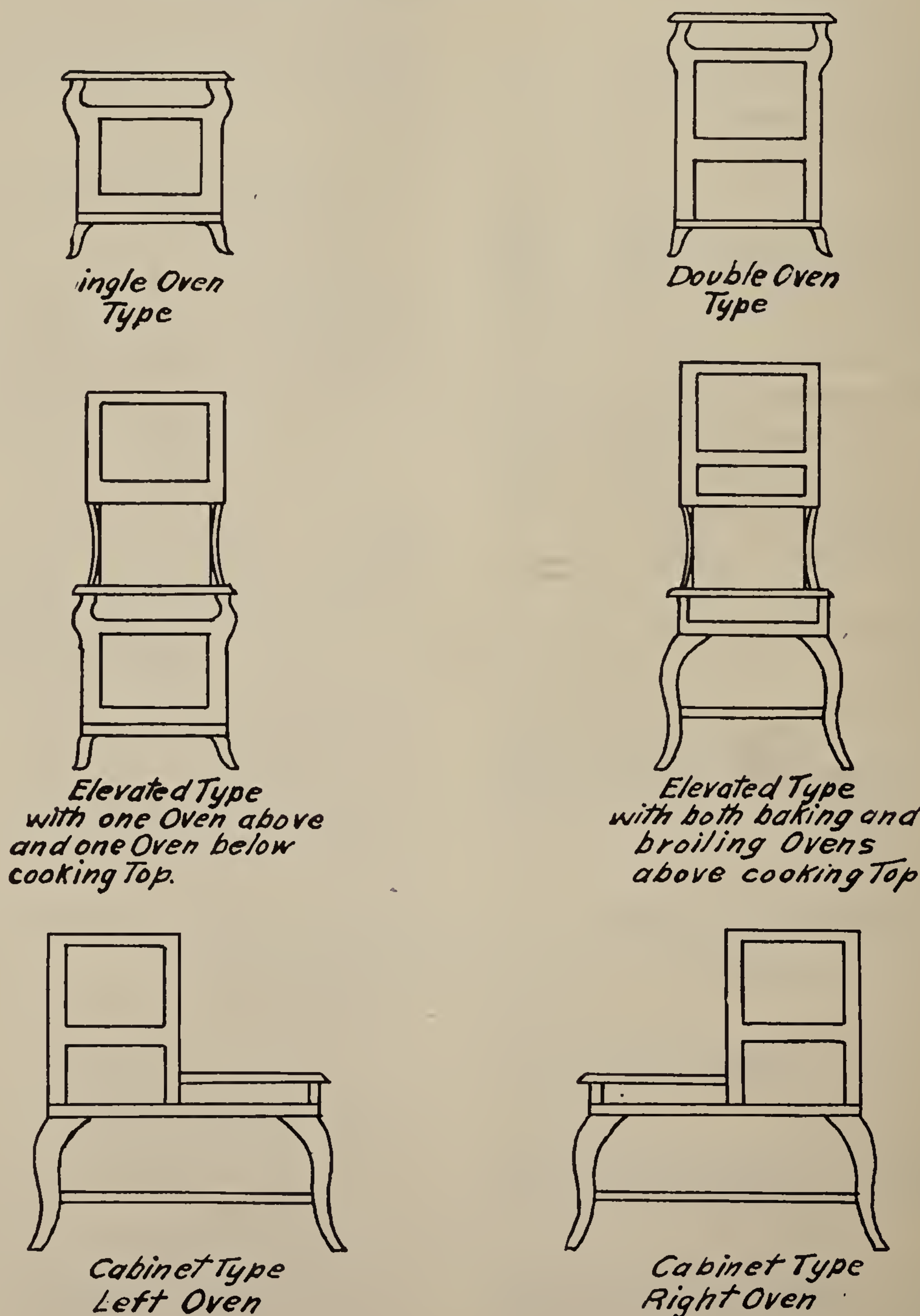
Broiler Back Lining.

Broiler Bottom.

Exhibit "B"

Diagram of Standard Range Types

NOTE: The purpose of this diagram is to define the Types referred to in the accompanying Specification.



Extreme Bottom.

Range Body—Oven Door Panel, Broiler Door Panel, Oven Door Lining, Broiler Door Lining, Burner Box.

Burner Box Lining.

Top Back Strip—the small sheet iron back strip at the top and back of high shelf or oven on Cabinet Range sometimes known as a mantle back.

Standard Abbreviations

G—Glass Door.

W—Roll Top Warming Closet.

C—Canopy Shelf.

N—Natural Gas.

R—Right Hand Oven Facing the Range.

L—Left Hand Oven Facing the Range.

E—Enameled Splasher.

It is understood that all ranges are equipped to be used with manufactured gas unless the letter "N" follows the number, signifying "Natural Gas."

In this connection the word "Manufactured" is to be used and not "Artificial."

Enameled Parts—are to be known as "Enameled Parts" and not as "Porcelain" or "Porcelain Enamel."

Exhibit C.

PERFORMANCE SPECIFICATIONS

Gas ranges for domestic use must conform to the following performance specifications:

Clause 1—General

(a) All ranges for the purpose of this specification shall be so constructed as to comply with the Standard Gas Range Specifications of the American Gas Association.

(b) All burner capacities for the purpose of this specification shall be determined with a gas pressure at the manifold equal to the normal gas pressure in the particular locality concerned and shall be expressed in B.t.u.'s per hour.

(c) Where adjustable orifices are used the entire investigation for the purpose of this specification is to be made with that orifice adjustment which provides the proper burner capacity as determined in tests No. 1, 2 and 3.

(d) Leakage for the purpose of this specification is defined as not exceeding 0.02 cu. ft. per hour.

Clause 2—Burner Capacities

(a) Top burners shall be capable of providing at the normal operating pressure the following heat units as determined by test No. 1.

Simmer Top Burner — not less than 1,800 B.t.u. per hour.

Single Top Burner—not less than 9,000 B.t.u. per hour.

Giant Top Burner—not less than 12,000 B. t. u. per hour.

(b) Baking oven burners shall provide at the normal operating pressure enough heat to heat the baking oven to 500° F. in not more than twenty minutes as determined by test No. 2,

(c) Broiling oven burners shall provide at the normal operating pressure not less than 150 B.t.u. per hour per sq. in. of broiling area as determined by test No. 3.

Clause 3—Burner Operating Characteristics

All burners shall fulfill the following requirements throughout the operating range of gas pressures, as determined by

test No. 4, with the same adjustment of the air shutter at any one gas pressure.

(a) Burners must not flash back upon immediate ignition, delayed ignition or turning the gas cock until the gas supply is one-sixth of the full supply of that gas pressure.

(b) Burners shall ignite completely and without hesitation.

(c) Burners shall operate under all test conditions without floating or carbonizing flames.

(d) Burners shall extinguish noiselessly.

Clause 4—Lighters

Top burner lighters with continuous pilots must operate without flame impingement on any part of the range and must provide immediate ignition.

Oven burner lighters shall not interfere with the combustion of the oven burners and shall provide immediate ignition at all operating gas pressures.

Clause 5—Adjustable Orifice

(a) When adjustable orifices are used the maximum drill size of the adjusting cap shall not exceed the following:

Simmer burner No. 55 M.T.D.

Top burners and double oven burner No. 31 M.T.D.

Single oven burner and single broiler burner No. 15 M.T.D.

(b) Adjustable gas cock must be capable of supplying the following maximum B.t.u. requirements per hour with a 40 percent primary air injection (of the total necessary for complete combustion) at 2″ pressure:

No. 55 M.T.D.—1,800 B.t.u.'s.

No. 31 M.T.D.—12,000 B.t.u.'s.

No. 15 M.T.D.—24,000 B.t.u.'s.

(c) The entire adjustment must be accomplished with a horizontal movement not in excess of 1/8″ and must require at least two turns of the cap to accomplish the adjustment from cut down position to full open position .

In order to fully take care of all requirements the adjustable cock used for the simmering burner (maximum drill size No. 55 M.T.D.) must be capable of closing down the gas to 1,200 B.t.u's at 6″ pressure and must be able to deliver 1,800 B.t.u's at 2″ pressure.

In order to fully take care of all requirements the adjustable cock used for the top burner or double oven burner (maximum drill size No. 31 M.T.D.) must be capable of closing down the gas to 8,000 B.t.u's at 6″ pressure and must be able to deliver 12,000 B.t.u's at 2″ pressure.

In order to fully take care of all requirements the adjustable cock used for the single oven burner or broiler oven burner (maximum drill size No. 15 M.T.D.) must be capable of closing down the gas to 16,000 B.t.u's at 6″ pressure and must be able to deliver 24,000 B.t.u's at 2″ pressure.

Clause 6—Fire Hazard

The maximum temperature rise above room temperature shall not exceed 90° F. at points 6″ from the back and sides of the range and on the floor under the range when the range has been operated at the highest operating gas pressure for a period of forty minutes as determined in test No. 5.

Clause 7—Flue Gas Analysis

A sample of the flue gases collected at the flue collar after both baking oven and broiler oven burners have been operating a half hour shall show no CO present when analyzed with an apparatus which is accurate to 0.1 % as determined in test No. 6.

Clause 8—Oven Heat Distribution

(a) The heat distribution in the baking oven shall be so uniform that biscuits distributed in the oven, heated to 450° F., will be evenly browned in not more than twenty minutes, as determined by test No. 7.

(b) The heat distribution in the broiler oven shall be so uniform that bread covering entire broiling area will be toasted to an even brown in not more than ten mintes as determined by test No. 8.

Clause 9—Thermostat

Where a thermostat controls the gas supply to the baking oven the temperature indicated by the thermostat shall not vary more than 20° F. from the temperature indicated by a recording thermometer or a glass bulb thermometer placed in the oven. This determination is made at 250° F., 350° F., 450° F., and 550° F., as in test No. 9.

Clause 10—Relief for Explosion

The oven doors shall open when a pulling force of fifty pounds is applied at each door handle in a direction which is normal to the plane of the door. This determination is made as in test No. 10.

Clause 11—Leakage

The manifolds and cocks, assembled, shall withstand an air pressure of 3 lbs. per sq. in. without leakage as determined in test No. 11.

STANDARD METHOD OF TEST FOR GAS RANGES

The range is connected to the outlet of a gas meter which should read to .01 cu .ft. with a U (water) gauge, calibrated in tenths of inches, next to the manifold to record the gas pressure and a gas pressure regulator of the float type at the meter inlet to vary the gas pressure as desired.

Test No. 1—Top Burner Capacities

The gas pressure is adjusted to its normal value. Where adjustable orifices are used the orifice for each burner is adjusted until the gas consumption satisfies the following formula:

Simmer—Gas Consumption = not less than $\dfrac{1800}{\text{Av. Calorific Value}}$

Single—Gas Consumption = not less than $\dfrac{9000}{\text{Av. Calorific Value}}$

Giant—Gas Consumption = not less than $\dfrac{12000}{\text{Av. Calorific Value}}$

Where fixed orifices are used the drilling of the orifices is made to satisfy the above formula.

Test No. 2—Baking Oven Burner Capacity

The gas pressure is adjusted to its normal value. A recording thermometer element or a glass bulb thermometer is inserted in the baking oven on a rack at the middle of the oven. The orifice is then adjusted to supply enough gas so that the oven will be heated to 500° F., in not more than 20 minutes. The gas consumption and the time to reach 500° F., are noted.

Test No. 3—Broiling Oven Burner Capacity

The broiling area is determined as that area covered by the broiler burner and extending 2″ on each side of the burner along the line of burner ports. Where two burners are supplied the broiling area is the area between the burners and the area which extends 2″ on the outside of each burner along the line of the outer burner ports.

The gas pressure is adjusted to its normal value and the orifice adjusted to satisfy the following formula:

$$\text{Gas Consumption} = \frac{\text{Broiling Area (sq. in.)} \times 150}{\text{Av. Calorific Value}}$$

The gas consumption in cu .ft. per hour is noted.

Test No. 4—Burner Operating Characteristics

Burners shall be operated through a pressure range from 40% above normal to 50% of the normal under the following conditions:

Immediate lighting.

Delayed lighting from two to twenty seconds.

Turning the gas cock to reduce the gas supply to one-sixth the full supply.

The top burners shall be covered with a cooking vessel of 8½″ diameter at base, and operation noted for floating or carbonizing flames.

The operation shall be noted at various air shutter adjustments.

Test No. 5—Fire Hazard

Two walls, drilled at 6″ horizontal and vertical intervals for thermometers, are placed 6″ from the range, one at the back and one at the oven side. Thermometers with blackened bulbs are placed in the openings protruding ⅛″ and also on the floor under the range. The gas pressure is adjusted to its maximum operating value, and the baking and broiler burners are operated at this condition for forty minutes. Where a locking device prevents operation of both burners at one time, then that burner which has the greater consumption is operated.

At the end of the test, wall and floor temperatures are recorded and the room temperature. The maximum temperature rise above room temperature is computed.

Test No. 6—Flue Gas Analysis

The oven burners are operated at the maximum operating gas pressure for a period of at least 30 minutes. A sample of flue gas is collected at the flue collar and is analyzed in a flue gas analysis apparatus which is accurate to 0.1 of 1%.

Test No. 7—Baking Oven Heat Distribution

The gas pressure is adjusted to its normal value. A recording thermometer element or a glass bulb thermometer is inserted in the baking oven on a rack. The oven is brought to a temperature of 450° F., and maintained at that point. Biscuit dough is distributed on a pan to all parts of the oven and allowed to heat for 20 minutes. The biscuits are then removed and the effect of their various locations in the oven is noted.

A recipe for the biscuit dough to be used in this test is the following:

2 cups flour
4 teaspoons baking powder
½ teaspoon salt
2 tablespoons shortening
¾ cup milk

Test No. 8—Broiling Oven Heat Distribution

The gas pressure is adjusted to its normal value. Wheat bread in ½″ slices is spread over the broiling area and brought 2″ below the flames of the broiler burner. After ten minutes or less the bread is removed and the heat distribution noted.

Test No. 9—Accuracy of Thermostat

The gas pressure is adjusted to its normal value. A recording thermometer element shall be placed on a rack in the baking oven and the readings noted when the thermostat is set for temperatures of 250° F., 350° F., 450° F. and 550° F. In each test the length of the test should be sufficient to allow the oven to come to a steady temperature.

Test No. 10—Relief for Explosion

A weight of 50 pounds is attached to the oven door handle by means of a wire which extends over a pulley. The direction of the pull must be perpendicular to the plane of the door.

This test is to be made for broiling and baking oven doors.

Test No. 11—Leakage

An air supply is connected to the meter inlet and the manifold and cocks subjected to an air pressure of 3 lbs. per sq. in. (6.9 inches of mercury). The test is made for at least 30 minutes and the leakage noted.

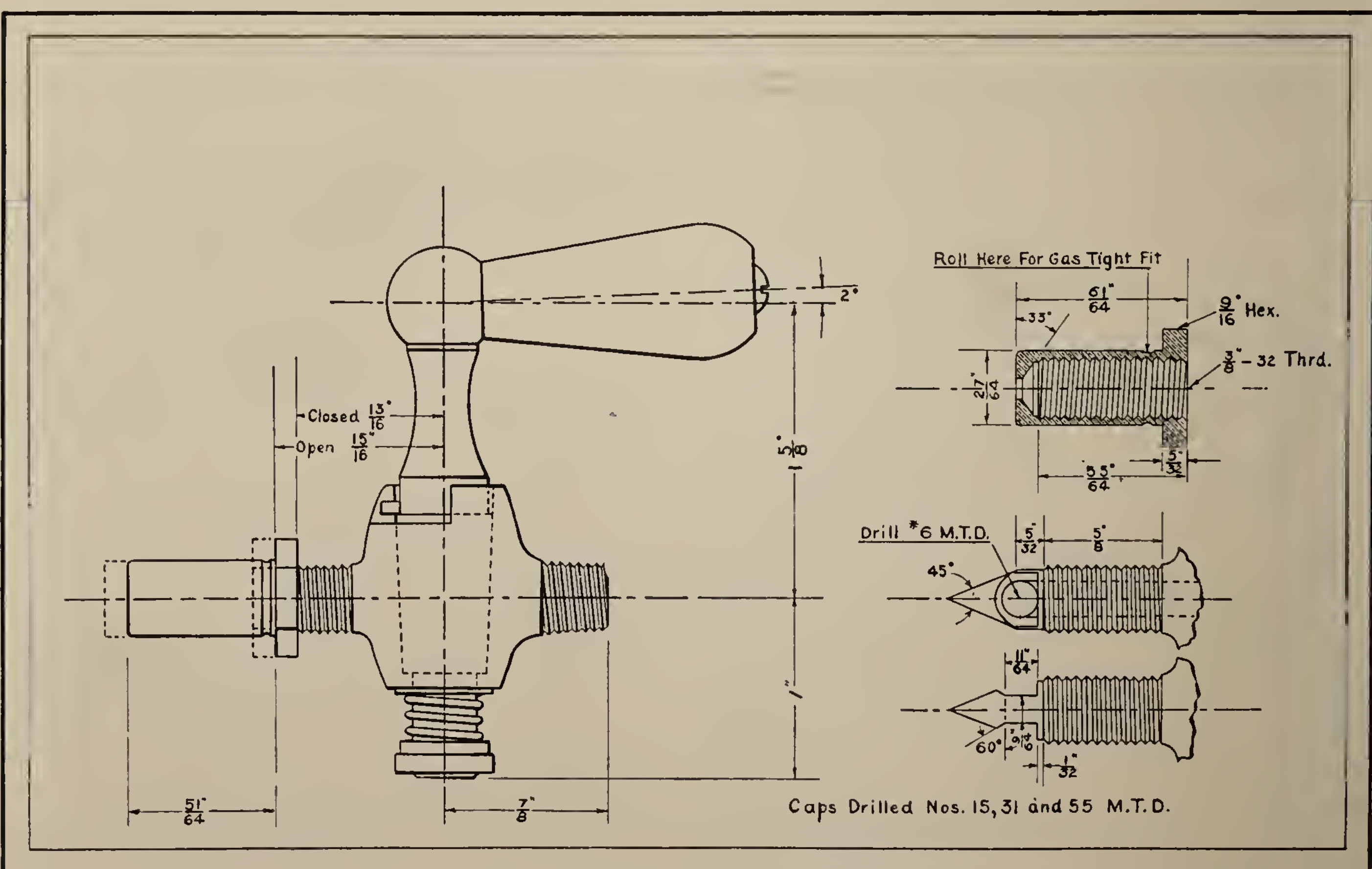
ADJUSTABLE GAS RANGE COCKS

Suggested Design

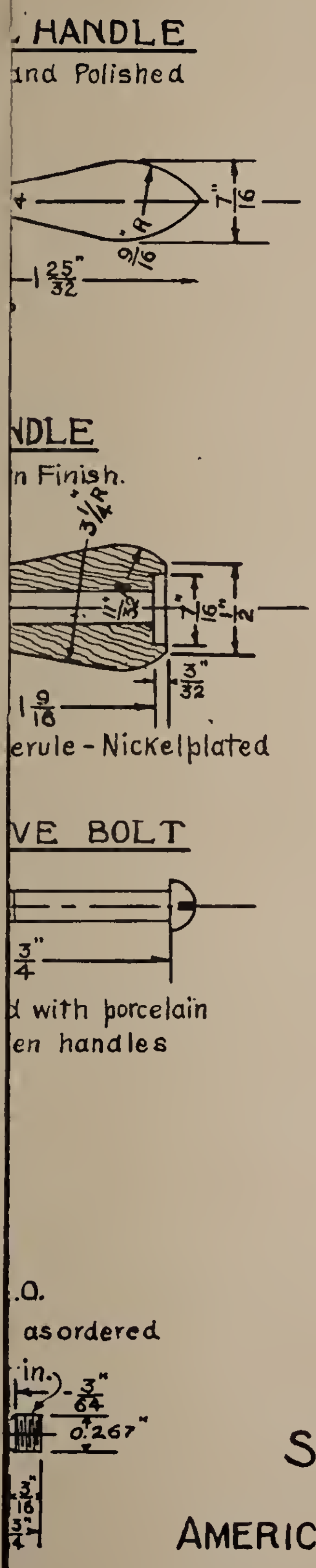
AMERICAN GAS ASSOCIATION
342 Madison Avenue
New York, N. Y.

"The design of the cap and orifice end of the adjustable cock is left to the manufacturer provided it conforms to the few limiting dimensions shown on Exhibit E, and that it accomplishes all the requirements stated in Clause 5 of the Performance Specifications."

"Should a manufacturer be unsuccessful in designing an adjustable end which meets with these requirements, the Committee then offers the design on which the best test results were obtained. The details of this adjustable end are presented here and offered as a suggestion to any manufacturer."



Note:— All designs must be submitted for test to the Chairman of the Specifications Committee, care of American Gas Association, 342 Madison Avenue, New York, N. Y. Detailed Description of approved designs will be shown in the A. G. A. Monthly directly after approval.



NOTE:-

1. Plugs to be ground in barrels.
2. All exposed parts of to be nickel plated.
3. The hole in the head of the plug for the $\frac{3}{16}''$ stove bolt to have tapered instead of straight threads, so that in assembling the cock this bolt will be held tightly in place.
4. To be no shoulder at end of $\frac{1}{8}''$ pipe thread but to be gradually tapered as shown.
5. All cocks to have a distinguishing mark cast in an inconspicuous place, to be submitted for approval.
6. The brass used in these cocks must conform as closely as possible to the following mixture:—

Copper	— 68 to 70 %
Zinc	— 18 to 25 %
Lead	— 6 to 8 %
Tin	— not over $1\frac{1}{2}$ %

STANDARD GAS RANGE COCK

AMERICAN GAS ASSOCIATION, INCORPORATED

EXHIBIT-D.

OF STANDARD GAS RANGE SPECIFICATIONS

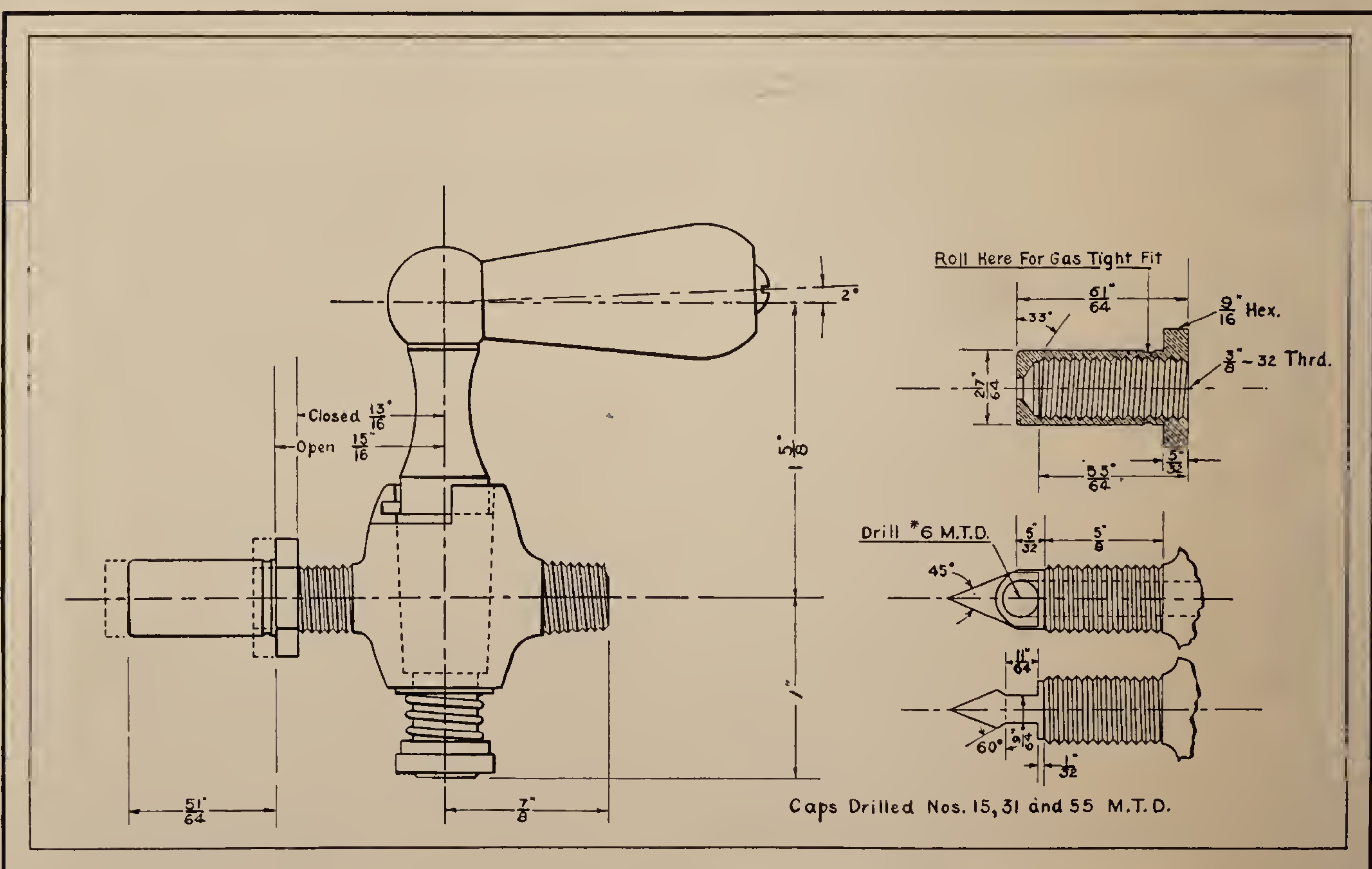
ADJUSTABLE GAS RANGE COCKS

Suggested Design

AMERICAN GAS ASSOCIATION
342 Madison Avenue
New York, N. Y.

"The design of the cap and orifice end of the adjustable cock is left to the manufacturer provided it conforms to the few limiting dimensions shown on Exhibit E, and that it accomplishes all the requirements stated in Clause 5 of the Performance Specifications."

"Should a manufacturer be unsuccessful in designing an adjustable end which meets with these requirements, the Committee then offers the design on which the best test results were obtained. The details of this adjustable end are presented here and offered as a suggestion to any manufacturer."



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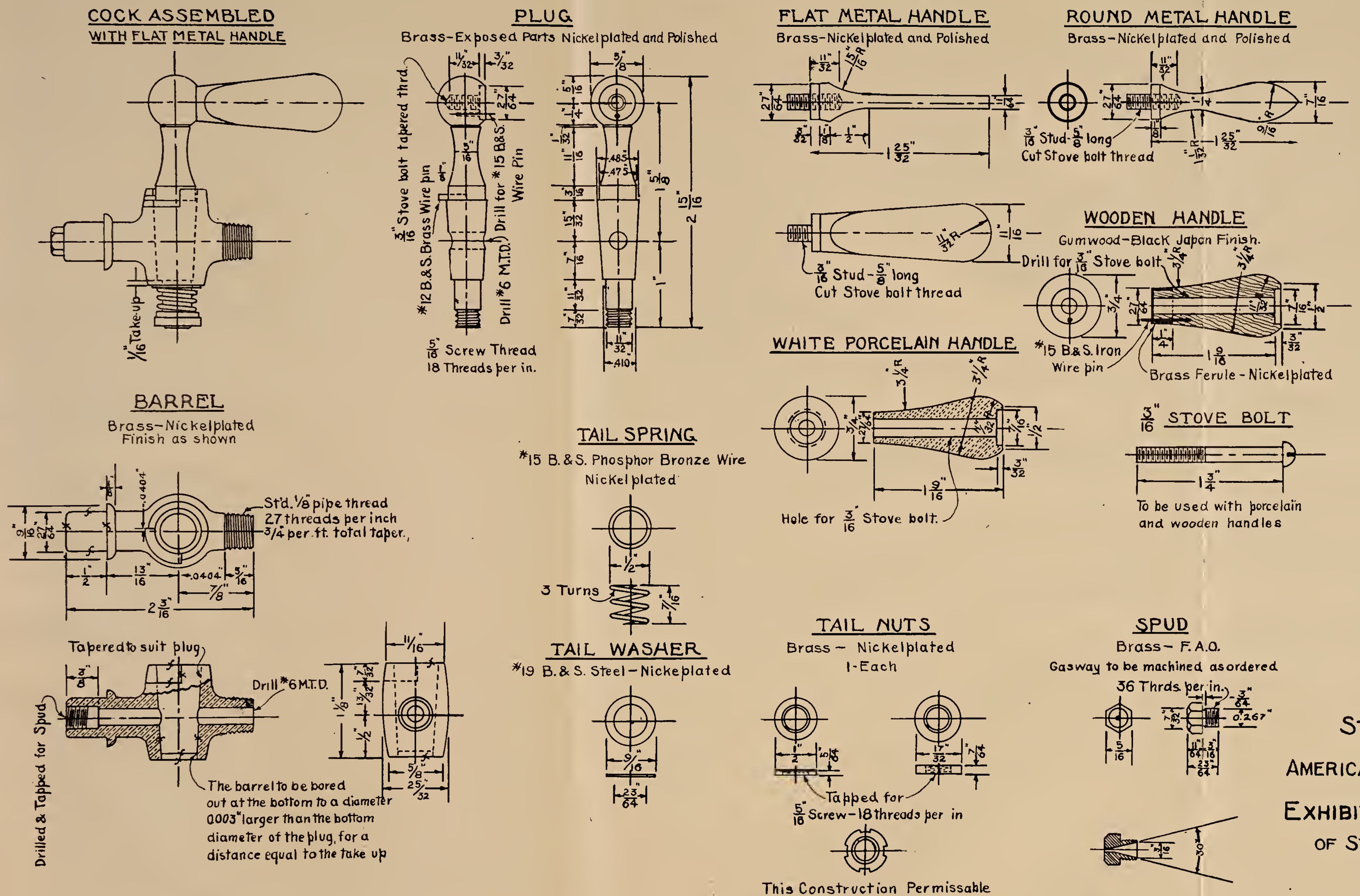


NOTE:-

1. Plugs to be ground in barrels.
2. All exposed parts of to be nickelplated.
3. The hole in the head of the plug for the 3/16" stove bolt to have tapered instead of straight threads, so that in assembling the cock this bolt will be held tightly in place.
4. To be no shoulder at end of 1/8" pipe thread but to be gradually tapered as shown.
5. All cocks to have a distinguishing mark cast in an inconspicuous place, to be submitted for approval.
6. The brass used in these cocks must conform as closely as possible to the following mixture:—

Copper — 68 to 70 %
Zinc — 18 to 25 %
Lead — 6 to 8 %
Tin — not over 1 1/2 %

STANDARD GAS RANGE COCK

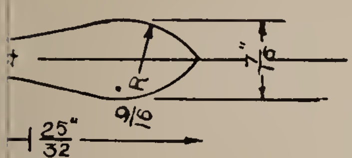
AMERICAN GAS ASSOCIATION, INCORPORATED

EXHIBIT-D.

OF STANDARD GAS RANGE SPECIFICATIONS

. HANDLE

and Polished



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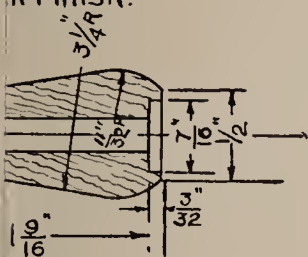

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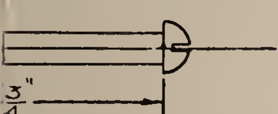

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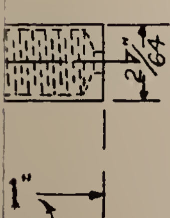


an

han 3/16

NOTE:-

1. Plugs to be ground in barrels.
2. All exposed parts of cock to be nickelplated.
3. The hole in the head of the plug for the $\frac{3}{16}$" stove bolt to have tapered instead of straight threads, so that in assembling the cock this bolt will be held tightly in place.
4. To be no shoulder at end of $\frac{1}{8}$" pipe thread but to be gradually tapered as shown.
5. All cocks to have a distinguishing mark cast in an inconspicuous place, to be submitted for approval.
6. The brass used in these cocks must conform as closely as possible to the following mixture:—

Copper - 68 to 70 %
Zinc - 18 to 25 %
Lead - 6 to 8 %
Tin - not over 1 1/2 %

NOTE

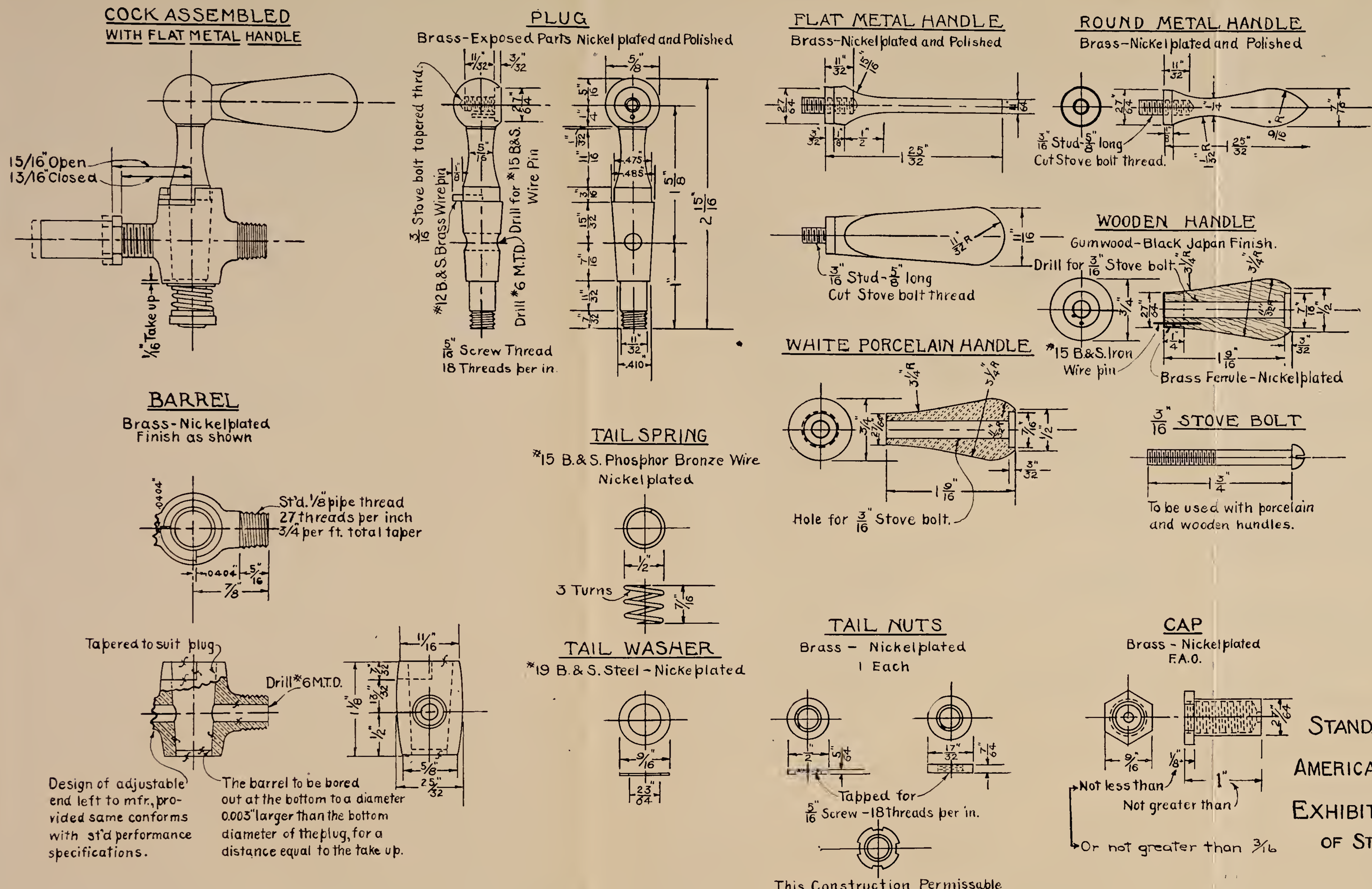
Cap closed, hex. end 13/16" from (not greater than) center line.
Cap open, hex. end 15/16" from (not greater than) center line.
Max. drill for Simmer #55 M.T.D.
" " " Top and double control oven burners #31 M.T.D.
" " " Single control oven or broiler burners #15 M.T.D.

STANDARD ADJUSTABLE GAS RANGE COCK.

AMERICAN GAS ASSOCIATION, INCORPORATED.

EXHIBIT-E.

OF STANDARD GAS RANGE SPECIFICATIONS.



NOTE:-

1. Plugs to be ground in barrels.
2. All exposed parts of cock to be nickel plated.
3. The hole in the head of the plug for the 3/16 stove bolt to have tapered instead of straight threads, so that in assembling the cock this bolt will be held tightly in place.
4. To be no shoulder at end of 1/8" pipe thread but to be gradually tapered as shown.
5. All cocks to have a distinguishing mark cast in an inconspicuous place, to be submitted for approval.
6. The brass used in these cocks must conform as closely as possible to the following mixture:—
   - Copper - 68 to 70 %
   - Zinc - 18 to 25 %
   - Lead - 6 to 8 %
   - Tin - not over 1 1/2 %

NOTE

Cap closed, hex. end 13/16" from (not greater than) center line.
Cap open, hex. end 15/16" from (not greater than) center line.
Max. drill for Simmer #55 M.T.D.
" " " Top and double control oven burners #31 M.T.D.
" " " Single control oven or broiler burners #15 M.T.D.

STANDARD ADJUSTABLE GAS RANGE COCK.

AMERICAN GAS ASSOCIATION, INCORPORATED.

EXHIBIT-E.

OF STANDARD GAS RANGE SPECIFICATIONS.

Official Marking
for
Appliances Conforming to A. G. A. Standard Specifications

Either of the two designs shown below are for use in marking appliances which are built in strict accordance with A. G. A. Specifications.

Design No. 1

Design No. 1 is particularly adaptable for marking appliances where such marking is to be applied directly to the appliance itself, such as by use of decalcomania, painting, etc.

Design No. 2

Design No. 2 can also be used in the same way as Design No. 1 but it is particularly adaptable for use as a metal tag to be fastened to the appliance.

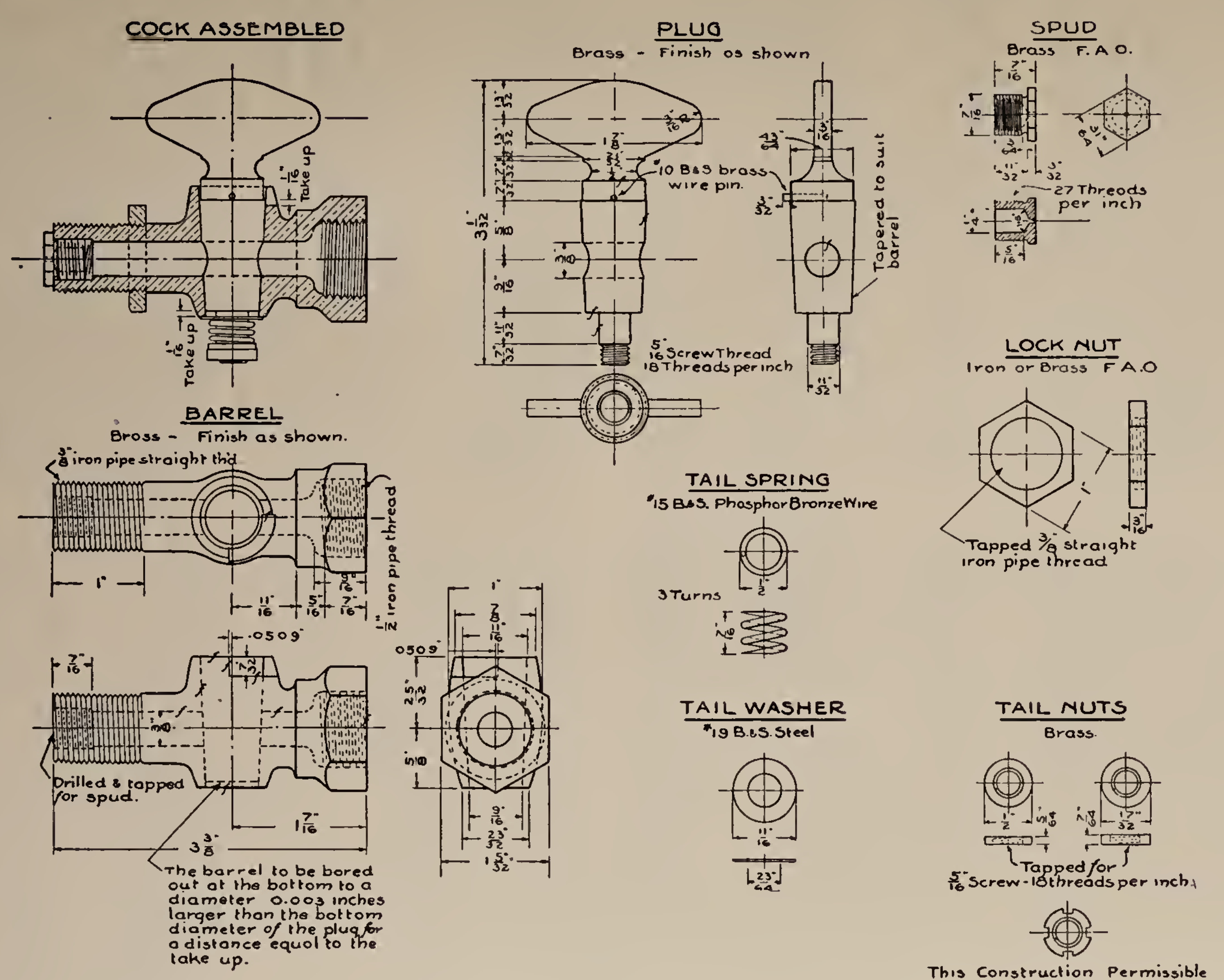
Note—Size or color used optional with manufacturer.

STANDARD CIRCULATING WATER HEATER COCK SPECIFICATION

Tentative

1923 Convention

Cocks for circulating water heaters are to be of the type known as the "Standard Circulating Water Heater Cock." All details and dimensions of this cock are to be in strict accordance with the drawing.



NOTE :-

1. Plugs to be ground in barrels
2. All exposed parts of cock to be nickel plated
3. To be no shoulder at end of 3/8" pipe thread
4. All cocks to have distinguishing mark cast in an inconspicuous place, to be submitted for approval.
5. The brass used in these cocks must conform as closely as possible to the following mixture :-

Copper	68 to 70%
Lead	6 to 8%
Zinc	18 to 25%
Tin	Not over 1½%

6. Cocks to be tested and required to remain tight and free from leaks under an air pressure of three pounds per square inch
7. A tolerance of 1/64 under to 1/32 over is allowed on overall dimensions of unfinished parts.
8. All iron pipe threads to be Briggs Standard

STANDARD CIRCULATING WATER HEATER COCK

AMERICAN GAS ASSOCIATION INCORPORATED

1923

STANDARD CODE FOR TESTING AND RATING UNVENTED GAS-FIRED STEAM RADIATORS

Tentative—1923 Convention

THE NECESSITY of testing unvented gas-fired steam radiators for safety, construction, operation and rating, is evident, if they are to be placed on a basis that conforms to established heating practice, and:

(a) For the protection of the public against buying inadequate installations of gas-fired steam radiators,

(b) That manufacturers may have a basic standard for the design of gas-fired steam radiation,

(c) That there shall be comparable data for the purchasing of gas-fired steam radiators,

(d) With the object of making the gas-fired steam radiator an appliance that will heat as much as possible by means of the steam generated by it; and as little as possible as a hot air heater, or that it shall be as much as possible like the commercial steam radiator in its kind of heating.

(e) To appropriately mark gas-fired steam radiators that conform to these A.G.A. Specifications.

The Rating of Unvented Gas-Fired Steam Radiators

In order to secure uniformity in the rating of steam radiators, the following definitions have been accepted:

1. The word "shall" where used is to be understood as mandatory, and "should" as advisory.

2. The rating of gas-fired steam radiators must be expressed in terms of square feet of radiation.

3. One square foot of surface of a standard column steam radiator is equivalent to one square foot of radiation and emits 240 B.t.u.'s per hour from a radiator standing in still air at 70°F. and with steam at 2 lbs. gauge pressure.

4. A British Thermal Unit (B.t.u.) is the quantity of heat required to raise the temperature of one pound of water 1°F.

5. The square feet of actual steam heating surface of a gas steam radiator is obtained by actual measurement of the steam or water backed surface of the radiator that is exposed to the air. It is measured by completely covering the surface with tin foil, then removing the foil, flattening it and measuring it by a planimeter or other accurate method; or another method is to weigh the tin foil used and compare the weight thus found with the weight of one square foot of tin

foil; or another method is to coat the surface with chalk or some substance upon which lines may be inscribed with a steel point. This surface will then be divided, as far as possible, into rectangular and triangular figures whose areas may be accurately measured.

6. The maximum allowable rating of gas steam radiators in square feet of radiation shall be equal to twice the actual square feet of heating surface.

7. The rating shall be calculated as follows:

The square feet of radiation equals the number of cubic feet of gas per hour through the by-pass spud at 2½″ gas pressure multiplied by the gross B.t.u. content of gas and divided by 240 B.t.u.

$$\text{Rating in square feet} = \frac{\text{Cu. ft gas per hr.} \times \text{Gross B.t.u. content}}{240 \text{ B.t.u.}}$$

8. These ratings shall be stated in whole numbers or in quarters (¼) or in thirds (⅓) as for example: 3, 3¼, 3⅓, 3½, 3⅔, 3¾, 4, etc.

The Testing of Unvented Gas-Fired Steam Radiators

9. The gas-fired steam radiator referred to, is an individual room heating appliance consisting of a cast iron radiator containing a water reservoir at the bottom, a gas burner element, and a regulating diaphragm. These parts are so assembled by the manufacturer that the appliance can be installed by making the external gas connection.

10. No testing for the efficiency of this type of appliance will be necessary since all of the heat in the gas will finally be available in the room. The testing, therefore, falls into the following three general classes:

SAFETY
OPERATION
CONSTRUCTION

11. Equipment needed for testing:

(a) Weighting scales, calibrated to ¼ pounds.

(b) Thermometers, calibrated to 1°F.

(c) Flue gas analyzing apparatus, calibrated to .001.

(d) Gas meter, accurate to within ½ of 1%, preferably a wet test meter.

(e) Gas pressure regulator, float type governor.

(f) Barometer, calibrated to 1/100th of an inch.

(g) U water gauges.

(h) Standard gas calorimeter.

(i) Steam pressure gauge calibrated to ¼ lbs.

12. Preliminary Adjustment:

Set up the appliance in accordance with the manufacturers' directions, inserting the gas pressure regulator and the test meter in the gas line. The U water gauge, to determine the gas pressure is placed just before the appliance. It is then necessary to determine the proper spud sizes which will pass an amount of gas that will produce no carbon monoxide (CO) in the products of combustion for both main and by-pass spuds when operating under 3½″ pressure of gas; and which will not exceed the maximum allowable rating for the radiator at 2½″ pressure. The main spud of the gas steam radiator should pass, approximately, one third more gas than the by-pass spud.

Safety

13. *Gas Explosion Hazard:*

The gas is turned on and allowed to flow for varying periods from 2 seconds to 20 seconds before lighting. There shall be sufficient openings to harmlessly dissipate the force of an explosion. The flames shall not flash outside the appliance.

14. *Fire Hazard Test:*

(a) The regulations of the National Board of Fire Underwriters require that the continued operation of a gas appliance must not raise the temperature of surrounding combustible material more than 90°F. from a normal temperature of 70°F. that is, a maximum of 160°F. If the surrounding combustible material reaches a higher temperature than 160°F. then it must be adequately protected.

(b) The radiator should be placed 6 inches from side and rear walls and should operate three hours without causing a temperature rise of more than 90°F.

15. *Safe Operating Steam Pressures:* Under normal operation in still air at 70°F. the steam pressure in the radiator should not exceed 5 pounds gauge pressure.

Operation

16. *Safe Burner Operation:*

(a) This test shall be run at gas pressures from 1.5 to 4.0 inches of water.

(b) The burners shall not flash back.

(c) The burner flames shall not impinge on each other or on a metal surface.

(d) The burner shall ignite and extinguish without undue noise .

(e) On lighting the burner, the flames should not flash outside the casing.

(f) The burner should be easy to inspect and should be easily removable.

17. *Fuel Governor Operation:* The gas-fired steam radiator shall be equipped with a fuel regulating governor which shall be automatic and operated by the steam. This governor shall be so constructed that in event of its failure there can be no possibility of steam entering the gas supply pipe.

Construction

18. The report on gas-fired steam radiators should give a full and detailed description of its construction. In every case this should contain:

(a) Overall dimensions
(b) Weight
(c) Number of sections
(d) Spud sizes
(e) Size and shape of heating surface
(f) Burner details
(g) Gas control governor
(h) Accessories
(i) General outside appearance.

The examination of the construction should further include the following:

Accessibility for Examination and Repairs

19. The sections, burners, controls, etc., should be readily removable and be easily examined.

Interchangeability

20. Interchangeability is determined by dismantling two samples and re-assembling with parts interchanged. Where only one sample is submitted, the investigator's opinion decides.

21. All unvented gas-fired steam radiators shall be equipped with a relief valve or steam safety valve.

22. An air valve.

23. A burner control cock, a quarter turn gas cock which shall have an opening through it large enough to pass the required gas without undue pressure drop. The cock shall have a tail spring.

24. Standard A.G.A. spuds.

25. An adjustable air shutter capable of giving complete shut-off. A set screw or other mechanical means shall hold the shutter so securely that accidental shifting is impossible.

26. A water filling connection which will establish a suitable water line and so constructed that it will prevent the water

syphoning into the radiator when filling.

27. A one-piece cast iron burner.

28. A burner that is capable of operating without a wire gauze.

29. All unvented gas-fired steam radiators which comply with the tests and specifications as above, may be marked A.G.A. Std. and this marking shall be cast on the end plate of the combustion chamber.

STANDARD CODE FOR TESTING AND RATING GAS-FIRED STEAM BOILERS

Tentative—1923 Convention

General Object, Method and Scope of Code

1. The object of this code is to provide a standard method of test and a standard method of rating gas-fired steam boilers.

2. Tests for high or low pressure boilers of either steel or cast iron construction are similar; they will be treated therefore, together, and exceptions noted where they occur.

3. All gas-fired boilers shall be constructed in accordance with the requirements of the A. S. M. E. Boiler Code covering Power Boilers, Heating Boilers and Miniature Boilers.

Setting and Connecting of Boiler for Test

Note: See Sketch No. 1.

The boiler is to be placed where it will not be subject to drafts.

The boiler shall not be connected to any chimney or stack, nor shall any flue piping be connected to the flue outlet of the boiler as provided by the manufacturer. The draft check provided by the manufacturer should be placed but not otherwise connected to any flue pipe.

Note: This provision is necessary in order to obtain absolute uniformity of operation, because of the numerous variables which a flue connection introduces, and also because in practice, installations of boilers are made where the flue creates little or no draft.

Gas connections are to be adequate to deliver the required amount of gas to the burners at not less than 3½″ pressure, when operating fully. The gas measuring device used must be of proven accuracy and provision made to measure the temperature and pressure of the gas at the meter. A water U gauge should be located in the gas line at a point immediately before any accessory valves, such as automatic control valves, safety shut-off valves, etc. A similar gauge is to be connected to the gas line at the burner manifold, at the end opposite to the gas connections. This gauge is to be used only to show the pressure drop through the auxiliary gas valves and manifold piping.

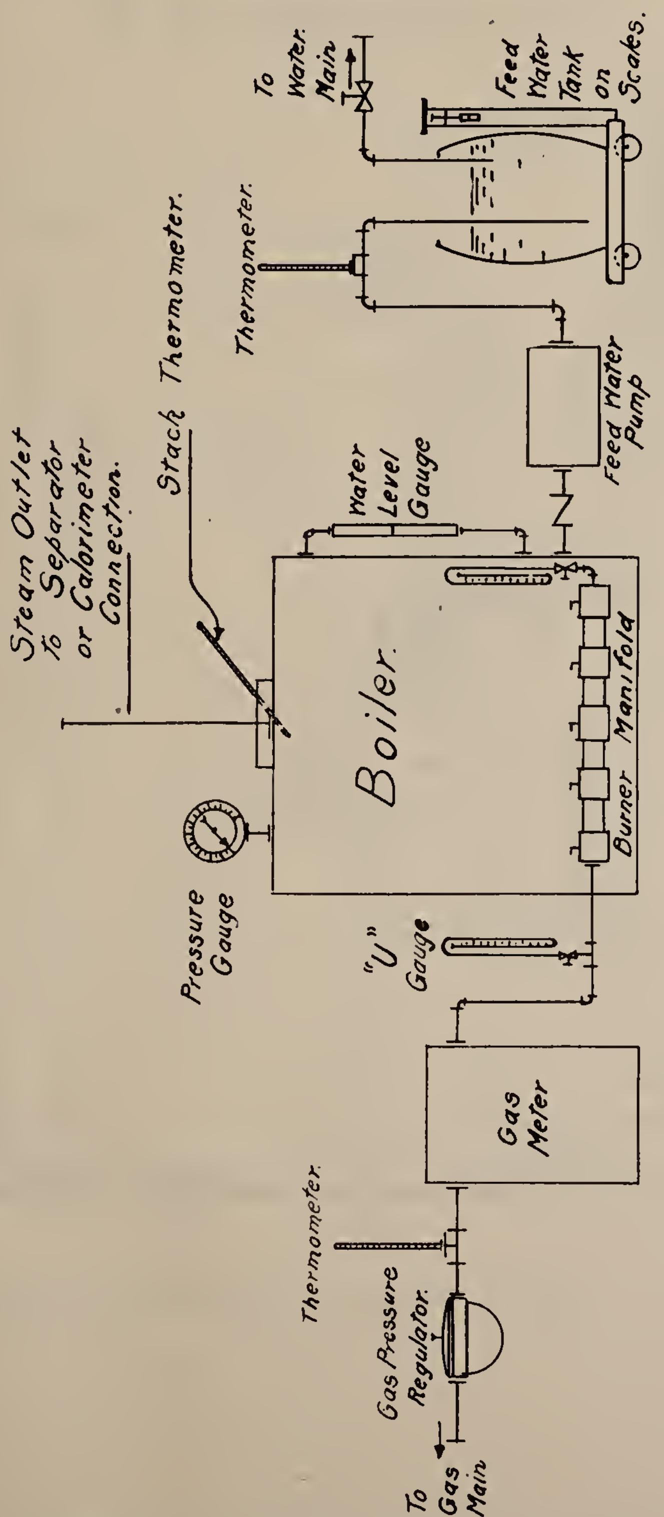
A barometer should be available for taking barometric pressure readings.

Feed water tanks may be calibrated or mounted on tested weighing scales, the water being fed to boiler by gravity, air pressure, or feed pumps.

For Industrial Boilers, the steam line from the boiler is to be provided with a vertical run of at least 3″ pipe of not less

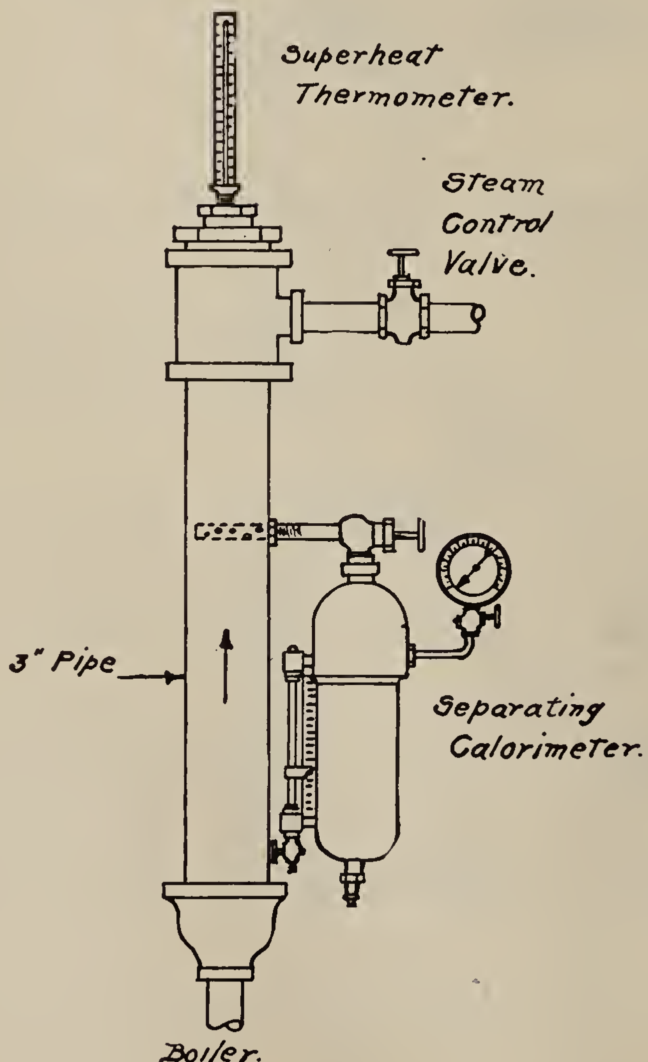
DIAGRAM OF TESTING LAYOUT FOR GAS FIRED STEAM BOILERS.

A. G. A. SKETCH No. 1. 1923.



METHOD OF CONNECTING SEPARATING CALORIMETER TO STEAM LINE.

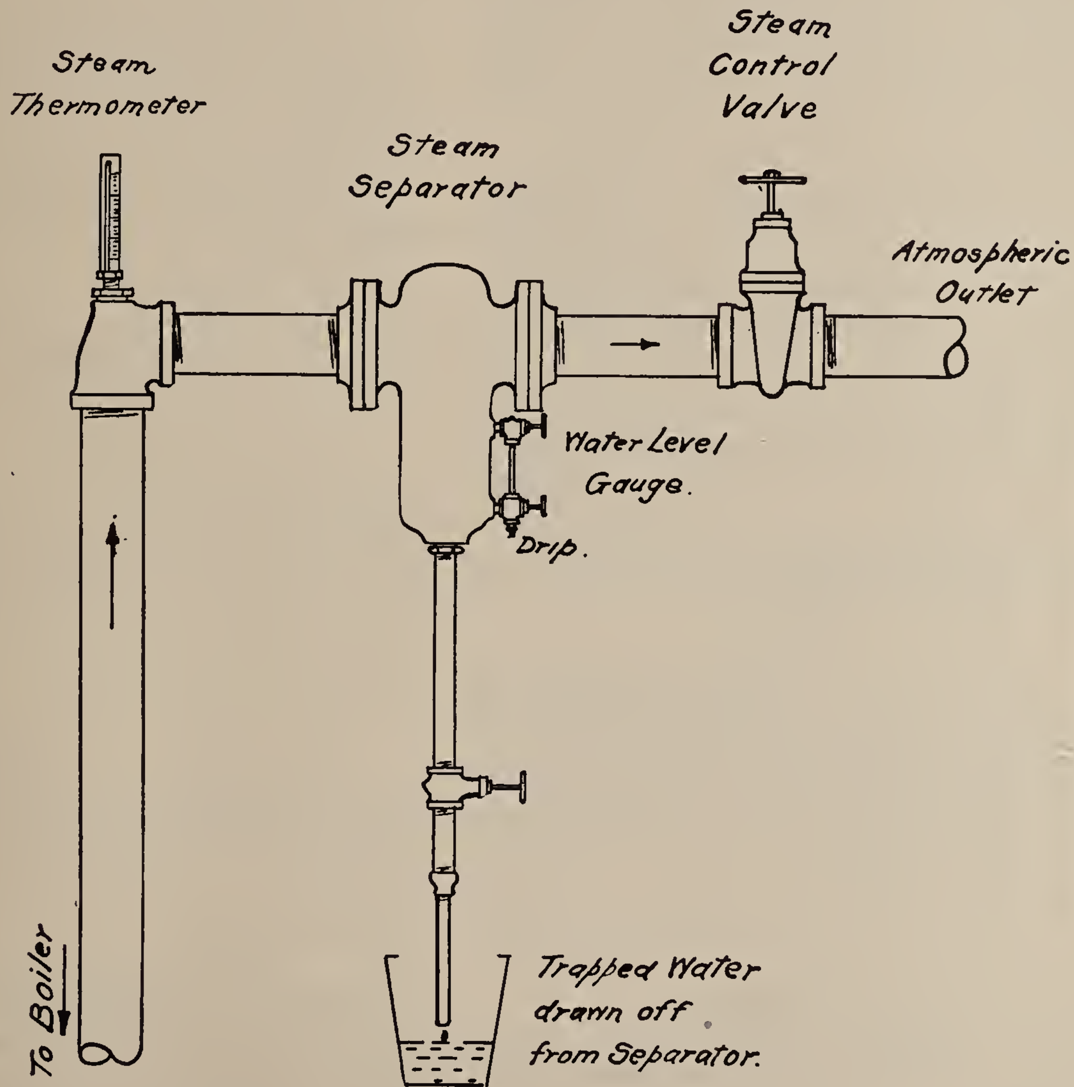
A. G. A. SKETCH No. 2. 1923.



Note: - All pipe and calorimeter completely lagged.

METHOD OF CONNECTING STEAM SEPARATOR
TO
STEAM LINE.

A.G.A. SKETCH No. 3 1923.



Note :- All pipe and separator completely lagged.

than two feet in length, to be placed as near as possible to the boiler. In this pipe is inserted the sampling tube of the steam calorimeter, as shown in Sketch No. 2. The steam line also must have a thermometer connection for measuring the temperature of the steam.

For House Heating Boilers, the moisture in the steam is to be determined by placing in the steam outlet, a steam separator of at least 95% efficiency and also a thermometer for obtaining the steam temperature. See Sketch No. 3.

The steam control valve is to be placed beyond the calorimeter or separator, thermometer, and pressure gauge connections. All steam piping and connections from the boiler to this valve and the calorimeter or separator, are to be heavily covered with an insulating material.

The boiler is to be equipped with a steam pressure gauge of known accuracy or a mercury U gauge.

Provision is to be made for taking the temperature of the flue gases immediately before their discharge from the boiler.

Provision also must be made for accurately drawing off samples of the flue gases for analysis.

List of Apparatus Required

1. Weighing scales, calibrated to ¼ pounds.

2. Small scales for weighing separator water.

3. Steam pressure gauge calibrated to 1 lb. or mercury gauge.

4. Thermometers:

(a) Steam	Calibrated to	1°F.
(b) Stack	" "	5°F.
(c) Gas	" "	1°F.
(d) Feed Water	" "	1°F.
(e) Room	" "	1°F.

5. Calorimeters:
   (a) Standard Gas Calorimeter.
   (b) Separating or throttling type of steam calorimeter for industrial boilers (60 lbs. pressure).
   or
   Standard Steam Separator of 95% efficiency for house heating boilers (2 lbs. pressure).

6. Flue gas analyzing apparatus, calibrated to .001.

7. Gas meter, accurate to within ½ of 1%, preferably a wet test meter.

8. Gas pressure regulator, float type governor.

9. Barometer, calibrated to 1/100th of an inch.

10. U gauges.

Test Procedure

Determination of Maximum Allowable Gas Consumption

This consumption is determined by setting the gas pressure at 3½″ water pressure and adjusting the gas orifices to the maximum size which does not produce CO in the flue gases.

The foregoing determination is made at 3½″ pressure in order to determine that the appliance does not create an explosion or fire hazard at that pressure, or exhibit any other undesirable operating characteristics.

Note "A"—The regulations of the National Board of Fire Underwriters require that an appliance shall not cause a rise of temperature on any surrounding combustible material of more than 90°F. from initial temperature of 70°F., or a total maximum temperature of 160°F. Where the temperature on combustible material is in excess of 160°F., the material is to be so protected by a non-combustible covering that it will conform with the above requirement.

Also, in some cities, there may be local ordinances or fire department rulings which must be met.

Note "B"—See note on following paragraph (Gas Pressure).

Gas Pressure

With the size of the gas orifices determined as above, the actual test for capacity and efficiency is then made, with gas at 2½″ water pressure. The above gas pressures are to be determined at a point immediately before all auxiliary gas valves or controls.

Note: In locations where the gas pressure conditions are widely at variance with the pressures given above, the test may be run at gas pressures approximating the average local pressure conditions In such a case the same method of test procedure must be followed in determining the maximum allowable gas consumption and the proper operating gas consumption. The latter shall be 70% of the former.

Duration of Tests

All tests shall be of not less than three hours duration, and shall be followed by a duplicate check test.

Test Pressures

Tests are to be run at the following steam pressures:

1. Industrial Boilers, 60 lbs. per sq. in.
2. House Heating Boilers, atmospheric pressure.

Starting and Stopping of Test

The test is to be started and stopped by what is known as the "flying" method, which consists in operating the boiler until all conditions reach equilibrium before starting the test and maintaining them until the end of the test period. It is important that the water level in the boiler be the same at the start and finish of the test and that it be held as nearly constant as possible throughout the test.

Control of Steam and Feed Water

Water is to be fed to the boiler at a uniform rate which will maintain a constant water level in the gauge glass. The flow of steam from the boiler is also to be maintained at a uniform rate.

Test Readings

Gas Consumption	every 10	minutes
Gas pressure	" 10	"
Gas temperature	" 10	"
Barometer	hourly	
Steam pressure	every 10	minutes
Steam temperature	" 10	"

Weight of water fed to boiler—as often as necessitated by size of tank and boiler.

Temperature of Feed Water—every 10 minutes.

Temperature of flue gases—every 10 minutes.

Quality of steam—hourly.

Calorific value of gas—hourly.

Flue gas analysis—hourly.

Note: Where rapid fluctuations or changes unavoidably occur, readings may have to be taken more often to insure accuracy.

Appended will be found report forms for test data and summary of results.

Rating

1. Industrial Boilers

The rating of these boilers shall be in horsepower and in Bt.u. output per hour which shall be numerically determined as follows:

$$\text{Rating in horsepower} = \frac{\text{Equivalent evaporation lbs. per hr.}}{34.5}$$

$$\text{Rating in B.t.u. output per hr.} = \text{Equiv. evaporation lbs. per hr.} \times 970.4$$

2. House Heating Boilers

The rating of these boilers shall be in terms of square feet of standard radiation and in B.t.u. output per hour which shall be numerically determined as follows:

$$\text{Rating in sq. ft.} = \frac{\text{Equiv. evaporation lbs. per hr.} \times 970.4}{240}$$

$$\text{Rating in B.t.u. output per hr.} = \text{Equiv. evaporation lbs. per hr.} \times 970.4$$

DATA AND RESULTS OF EVAPORATION TEST

1. Name of Boiler ....
2. Manufacturer's Rating .... Bl. H.P.
3. Date of Test ....
4. Duration of Test .... Hrs.
5. Steam Pressure .... Lbs. per sq. in.
6. Temperature of Steam .... °F.
7. Temperature of Feed Water .... °F.
8. Temperature of Gas at Meter .... °F.
9. Temperature of Flue Gas .... °F.
10. Barometer Reading .... Ins. Hg.
11. Gas Pressure at Burners .... Ins. H_2O.
12. Total Gas Consumption .... Cu. Ft.
13. Total Gas Consumption, Corrected to 60° F. and 30.00 ins Hg. .... Cu. Ft.
14. Total Gas Consumption per hour corrected (Item 13) ÷ (Item 4) .. Cu. Ft.
15. Calorific Value (of 1 cu. ft. of gas by calorimeter) (gross corrected) B.t.u.
16. Total heat available (Item 13) × (Item 15) .... B.t.u.
17. Total heat available per hour (Item 16) ÷ (Item 4) .... B.t.u.
18. Total weight of water fed to boiler .... Lbs.
19. Total weight of water fed to boiler per hour .... Lbs.
20. Quality of Steam .... *
21. Factor of evaporation = (H—h) ÷ 970.4[1] ....
22. Total weight of water actually evaporated, corrected for moisture .... Lbs.
23. Equiv. evaporation from and at 212° F. Cor. (Item 22) × (Item 21) . Lbs.
24. Equivalent Evaporation from and at 212° F. Corr. per hr. (Item 23) ÷ (Item 4) .... Lbs.
25. Total heat absorbed by boiler (Item 23 × 970.4) .... B.t.u.
26. Total heat absorbed by boiler per hr. (Item 25) ÷ (Item 4) .... B.t.u.
27. Horsepower developed (Item 24) ÷ 34.5 .... B.H.P.
28. Percentage of builders rated h.p. developed (Item 27) ÷ (Item 2) .... %
29. Thermal efficiency 100 (Item 25 ÷ (Item 16) .... %
30. Equivalent evaporation from and at 212° F. per cu. ft. of gas (Item 23) ÷ (Item 13) .... Lbs.
31. Gas consumed per boiler horsepower (Item 14) ÷ (Item 27) .... Cu. Ft.

CO_2 in flue gas .... %
O_2 " " " .... %
CO " " " .... %
N_2 " " " .... %

*If steam is wet—per cent moisture.
If steam is superheated; degrees Fahrenheit of superheat.

Note: In all calculations of efficiency or other factors based upon the heat content of gas, the gross corrected calorific value shall be used.

[1]H = total heat in steam at test pressure.
h = total heat in feed water (Item 7-32° F.).

REPORT FORM FOR EVAPORATION TEST OF GAS FIRED STEAM BOILERS

Name of Boiler—
Date of Test—

Barometer Reading—Ins. Hg.
Room Temperature—°F.
Correction Factor—

Time	Gas Meter Reading Cu. Ft.	Gas Cons. Cu. Ft.	*Pressures*		*Temperatures Deg. Fahr.*				Wgt. of water *Fed to Boiler Lb.*			Gas *Analysis %*			Calorimtr. Separator Readings.
			Gas Ins. H_2O	Steam Lbs. Sq. In.	Gas at Meter	Steam	Feed Water	Flue	Gross	Tare	Net	CO_2	O	CO	

Calorific Value of Gas
Gross
Corrected

Tested by—

MINUTES OF THE PUBLICITY AND ADVERTISING SECTION

FIRST SESSION

Tuesday Afternoon, October 16, 1923.

The first session of the Publicity and Advertising Section was called to order by the Chairman, Mr. B. J. Mullaney, the attendance being approximately 200 members and guests.

The Chairman: The idea of this afternoon's sectional session is that instead of having formal papers it will give an opportunity to directors and other members of the state committees on public utility information or similar organizations to come together with such executives and others as might be interested, and to discuss in a purely informal, close down to the ground way, with our coats off and in our shirt sleeves, so to speak, the various questions that may occur to us or be suggested impinging upon this whole general subject of state committee work and publicity and advertising effort for gas companies; and correlatively, of course, for all other kinds of public utility companies, because most of us are interested in some of the others as well as we are in gas companies.

Now in default of any fixed program there are three questions in the official program which might form a starting point. One question that has been raised by some directors of the state committees is: "Where in this work of ours is the dividing line between proper publicity, as it is called on one hand, and propaganda or advertising, as it is called on the other hand?"

My recollection is that the question arose out of some action on the part of newspaper organizations that make it a practice to circularize their membership to beware of certain organizations like ours, or analogous to ours, which are trying to grab free publicity, as they express it, where they ought to spend money for advertising.

It is the belief of some men engaged in our work that there is perhaps a proper dividing line, that a lot of things that we do could not be done by means of straight commercial advertising, paid space in newspapers; and that there is a dividing line probably somewhere between straight advertising work and what might be called publicity work or the furnishing of legitimate informational news which publications of various kinds might be expected to make use of without corresponding activity in it.

Now that is one question to start with, and there are two others that you can see for yourselves. The program is yours and my only function is to help stir it along. I would like to hear somebody express himself on that question.

Frank L. Blanchard (New York, N. Y.): When I was engaged by Henry L. Doherty and Company to establish a securities information department, I told Mr. Frueauff, who had engaged me, that he must not expect that I was going to devote myself to any press agent work. By "press agent" work he understood

exactly what I meant, because he made no further inquiry as to what I did mean. I told him that all I was going to do for the company as far as furnishing the news to the papers was concerned, was to see that the newspapers were supplied with whatever proper news arose in our field and among our companies that I thought might be of interest to the public.

I have held to that process or that formula of service since then. We have not sent out anything of a propaganda nature. We have not issued anything to boom any one member of our organization, even the chief. We have sent out nothing about Mr. Doherty except in the way of legitimate news. What has been the result?

Invariably the newspapers of New York carry, if they have room—sometimes they are crowded and they cannot print even important news—the stuff I send out. The editors know when they see an envelope come into the office from the Doherty organization that it contains something that has a news value and they do not hesitate, as I said before, to use it.

Now the difference between legitimate news and press agent stuff is this, as I see it: Press agent stuff is sent out with a view of influencing public opinion in an advertising way. It is matter that is concealed under the form of reading matter. Sometimes it is a story invented about the company or some one of the companies; sometimes about people who are connected with the organization.

Well, now, press agents, as we knew them heretofore, have been attached to circuses, to companies that are trying to get advertising across in the form of reading notices or reading matter and that sort of thing. Now I think you gentlemen who have had experience in this field will agree with me that there is no place today in our field and among our companies for a press agent. Press agents do not stand well with the newspapers. They are always trying to get something across of an advertising nature and the newspapers do not like it.

You know that the American Newspaper Publishers Association awhile ago carried on a very active campaign among the members of that organization directed against press agent matter. It was instrumental, I believe, in very materially reducing the amount of matter that was printed from these several companies that used to impose upon them.

Legitimate news is always welcomed by the newspapers. If you have got anything to put across in the way of advertising or of an advertising nature, use the advertising columns. That is where it properly belongs. I think a great many people have a false idea regarding the appearance of matter in an editorial form in the newspapers. In the first place, the newspapers will not allow you to say things in any article you send that way that will have a real advertising value. You can put into an advertisement anything that you want. That blue pencil is not in evidence in the advertising department.

Of course, the advertising man is always welcome in the business office of the newspaper. I think that if people would only get the idea that legitimate news is always welcome, we would perhaps go a long way towards establishing cordial relations with the newspapers. How many men are there here today who are personally acquainted with the newspaper men of their city, who will gladly see them when they call, who give

them information when the men come and ask for it? How many of you cultivate the newspaper men, meet them more than half way, tell them that anything you have in the way of news you will be glad to give them at any time? Sometimes I know things occur in our companies that we do not care to have published, but if you come out frankly and tell the newspaper men that fact they will respect your confidence and they will not print that which you do not want them to print.

Irving M. Tuteur (Chicago, Ill.): I think that any public utility in considering what is news and what is propaganda should look at it not from their own standpoint, but from the standpoint of public interest. Does this concern the public more than it does us? And, as a rule, if it is of that interest to the public you will find that your article will take on a semblance of news and that it will get publicity.

I have personal knowledge at this time of a company operating in a middle western state that has at its head a very able advertising and publicity man—and I mention this to show that you cannot always accomplish what you want to accomplish merely through obtaining a large amount of publicity in the newspapers. The particular company that I am thinking of is engaged in the sale of its securities to the public. Since the first of the year it has had no less than three thousand columns of free publicity in these newspapers, but the sale of the company's securities, despite that wonderful showing, has not gone forward in the way that it should. It seems to me that while there are a lot of contributing factors, that one of the reasons is that this company had been too much interested in what it could obtain in a free sort of way. Had it purchased advertising space and paid real money for it, and had it shown to the people who read those papers that it believed sufficiently in its story, the results would have been better.

W. H. Hodge (Chicago, Ill.): My mind goes back to the days when I was a newspaper reporter in Omaha about twenty years ago. I remember very well that as the city hall reporter for the Omaha Bee, it was my duty to keep in touch with utilities out there. The general manager of one utility that I visited practically every day did not want to see me. There were also two other gas officials who were rather difficult to see. The street railway people were fairly good, but the electric light and power company was always available and had the most publicity, which was simply real news manufactured by myself in the line of my duty as a newspaper reporter.

In 1910, when I went with my organization, the idea was to start an advertising and publicity department. That was handled by one department and that is the way we still handle it after thirteen years' work. In 1910 we began to send out a little mimeographed news bulletin, and that has since become a printed sheet. The idea of that had nothing to do with our department at all. It was a metropolitan paper printed from the financial side and I have always made a very strenuous attempt not to crowd the papers, not ask for anything excepting what is news.

We tried six or seven years ago to cut out that weekly bulletin and once we did discontinue it for about two weeks, with the result that twenty-five or thirty financial editors and writers asked us what the trouble was and why it was discontinued, all of them saying that they would like to continue to receive it.

As to a line between advertising and publicity, it seems to me that almost everything has a news value at one time or another. But if you are going to directly obtain attention it falls out of the news category right away and it has got to go to advertising.

The remark of Mr. Tuteur's that almost any amount of good publicity matter in the news columns does not necessarily lead to the sale of securities or appliances or anything else, is absolutely true. Advertising is part of merchandising. Publicity is a different thing entirely, in my opinion. I personally have always felt that publicity is a rather delicate subject matter. I think it can easily be overdone; it must be handled with a good deal of moderation and restraint.

I have always felt that the personal contact established, is, after all, the main thing. I look upon the state committees —I am a member of the Illinois Committee—as extremely valuable in a number of ways, but primarily because they are a medium of compiling, collecting and originating matter of interest and getting it out in a regular way, in a way not offensive to a newspaper publisher.

The Chairman: I would like to mention a specific instance by way of supporting the idea advanced by Mr. Blanchard of the necessity, in handling publicity work and establishing confidence in the newspaper offices, that the matter going to them from a public utility company is dependable as news and has not got any snakes in it.

Let me give you an illustration of how that works out sometimes to the very great advantage of the company concerned. In our town, not very long ago, the gas company was threatened with a strike, the strike of all the people concerned in the production of gas, a very serious matter. Any of you who have ever had dealings with labor reporters, particularly in the larger cities, know that the labor reporter is hard-boiled. His first interest is the labor union's side of it because it is from the business agents and presidents of unions that he gets his news and the news that he drags into his paper is what he lives on. So that he is not intentionally, but by virtue of the circumstances, prejudiced against the employer's side at the start.

Now it seemed to some of us by reason of the relations that have been established over a period of years between this company and the newspapers, so that newspaper offices could have confidence that they were not going to be fooled or strung or lied to in matter coming out from this company, that it was possible not only through the labor reporters but through city editors to get this point of view across in the initial stages when they talked about the strike: That the thing concerned in the strike was not a few dollars that the gas company might have to pay these men in addition to their wages, and it was not a matter of just what wages the men were going to get; that if the company had to increase wages it would probably go back to the commission and get that out of the consumer, but the main point was that the gas supply of the city of Chicago should not be interrupted by a strike. That idea was put across and it just pervaded and overshadowed every other phase of the discussion of that strike. To my notion it was a very large factor in contributing to a settlement of the dispute without any strike, which was what everybody concerned, at least on the gas company's side of the fence, wanted to be brought

about. I just mention that as illustrating the by-product advantage, the retroactive effect of establishing confidence between the publicity office and the newspaper office.

Since we started, Mr. St. Clair of the American Electric Railway Association has entered the room. The thing we are discussing here is the dividing line between proper publicity effort on the one hand and straight propaganda or advertising on the other. Let us hear from him.

Labert St. Clair (New York, N. Y.): I have always felt very keenly on this point that you are discussing now. There is a very sharp dividing line and it is not much trouble for the good reporter or the good advertising man to recognize it. The greatest trouble sometimes is to get the boss to recognize it.

I think that it is absolutely wrong to ask any city editor to carry anything in his columns that ought to go into the paid advertising columns. We all recognize what should be paid for and what should not be paid for, and so far as our work is concerned, we make it a point to lay off anything that may savor of trying to put something over. That is the best general rule I know of. Everybody recognizes it and you do not need to discuss it at any length at all.

Alfred Fischer (Ann Arbor, Mich.): I want to tell you about an experience that I had in my state with two publishers who returned editorial material, that I sent out last year, through the medium of their press association. I got this stuff back in a large envelope with about six cents postage due, which I learned later is standard practice and is expected to have the psychological effect of the slap in the face. I also received a form on which the name of the paper was rubber stamped, saying, "that this sort of material was not acceptable and please cut it out."

This convinced me that they were putting my stuff in the same class with that of Ford carbureters and special springs and other things to make the universal car run easily. I immediately wrote a letter to each of the editors of these papers informing them that I had received this information from their secretary and telling them that I was taking them off the list at once and would keep them off until such time as they wanted to get back on. A letter came by return mail from the editor of the larger of the two papers asking to be put back at once, stating that the inclusion of our stuff had been a mistake. They had sent back a whole lot of press matter sent them from advertising agents and others and a couple of pieces of copy from my committee had gotten in by mistake. They said it was industrial news service which they found useful and they would like to keep on getting it, so would I please put them right back on. That settled one.

The other one stood pat and nothing was done for some six or eight months. It was way up in the wilds of upper Michigan and this thing happened in the fall. In the following spring when the icebergs went out I made a trip up there and found a very unhealthy local situation with one of the utilities. I found that the manager—and it happens to be the gas manager—had not been on speaking terms with the publisher of the newspaper for a long time.

After spending a morning in that office and learning all I could about the local situation, telling these folks what they could do if they wished to in a systematic business manner towards im-

proving their local situation, the last thing I said as I was ready to go was, "By the way, are you getting this dope from our office?" and the editor grinned a little bit and said, "Why no, we aren't." I said, "Let's see, didn't you send a letter in to the Inland Press Association asking them to be taken off?" He said, "Yes, we did." "You have been off ever since?" "Yes, but since you have been up here and since we have learned a little bit of what you are doing and what you have in mind, that you are not trying to exploit anybody, we would like to get back on that list," and they are back on it now. Those are the only instances of that sort that I have ever seen.

But I have been just a little bit amused in my own corner to find these bitter campaigns and this mass of oratory from the secretaries and others connected with publishers' associations against free publicity, and then a few months later to see somebody come out and say, "Why, we who are sending out free publicity are urging our companies to advertise, urging them to buy space, to make contracts that would represent a certain expenditure of their gross receipts." And first thing you know everything is lovely. The copy is welcome and anything that we have to say is received with open arms and used if there is any excuse for using it at all. In its final analysis, I suppose, it is the sensible thing for them to do because they realize that we are not going to put anything over on them. But I do not like to go to an experience meeting and have somebody get up and tell about the curse of free publicity and then go home and say to half the publicity men that they preach against, "We didn't mean you. You are in favor of newspaper advertising so you don't count. You keep right on with your service."

As I said in the beginning, I believe that this is not a serious question insofar as utility information is concerned. I have not seen anything that can be honestly labeled press agent stuff in any news bulletins or in the product of any of the utility information bureaus. It is really a discussion which will mean a great deal more to the people we are working for who have not been in a position to learn that fine line of discrimination beyond which they cannot go.

H. M. Lytle (Chicago, Ill.): I do not know of a more difficult subject to discuss than this. I had no publicity, press agent, or other experience when I went into this work except news experience. However, my scrap has always been against the press agent's stuff. I know what it is and so does every other newspaper man.

When my committee was started I was not employed to press agent the industry and they had no idea that I was. We had no understanding that it was my job to put over anything on newspapers or anybody else. I have had a very fine experience with the newspapers, and one reason is because I never regarded the matter in our news bulletin as spot news—by that I mean news that had just broken. I always regarded the matter as time copy, matter that might be clipped, stuck on the hook and used at some future time.

For instance, every newspaper man in the room knows how extremely difficult it is to put over anything on the Associated Press. They know propaganda and press agent stuff. They have carried our stories time and again. One of them in the gas industry was more than a

hundred years old. Now, that was not propaganda; it was not press agenting; it was time copy that was sent out in the mail service and as such was news. At a meeting of the electric railway people last week, the thing that disturbed me a whole lot was the reference made to the directors of the state committees as being advertising men. Of course, that is an entirely wrong conception of their function.

Another point that seemed to stick in the minds of the executives was that these directors were there selling something to them. Of course, that is far from the fact. Every state committee is formed long before the director's name is even mentioned. He is merely the machinery of the state committee. He has nothing to sell. If he is not good they will get a new machine to put in his place. Those two things, I think, directors have to overcome in each of their states because it is getting the shoe on the wrong foot; in other words, putting the director out as an organization rather than these committees out as an organization.

H. C. Abell (New York, N. Y.): One gentleman has made the suggestion that public utility operators in the various communities should become acquainted with the newspaper men. I think that is absolutely essential. In all the properties that I have had to do with in the past few years, the first thing we did was to become acquainted with the newspaper publishers, editors and reporters.

Now the line of demarcation between advertising and propaganda is very hard to draw. I do not agree with Mr. St. Clair on that at all, because in the first place, a public utility is what? A public utility is doing the job that the city itself might do and therefore, every act of the public utility is of importance and interest to the community as a whole. When you look at it from that viewpoint as agent of the city—and you have got to look at it from that viewpoint—every act of that public utility is of interest to the citizens of that community. Now, how are you going to draw the line of demarcation between advertising and propaganda?

Recently I have had to do with the reorganization of quite a number of companies in the hands of receivers, and it made it necessary for us to do a good deal of advertising and educational work. I found that in every instance the best way was to take the newspaper men into our confidence. We got the newspaper men and said: "This is a problem of vital importance to the community. Where do we get off? We want to get something before the public. If this goes in as advertising matter nobody will read it. If it goes in as news they are going to read it!" I found that to be a very helpful way of going after this problem. The newspaper men in a great many instances would outline a policy of advertising and then supplement that themselves by editorials and news items in the papers, bringing out the various things that we were working for.

J. B. Groce (Boston, Mass.): Most of the state committees go under the title of State Information Bureaus. If we directors live up to that name, supplying the information, there will never be any trouble. We send out bulletins which are supposed to give information. If we have any propaganda in them it is indirect propaganda, in my judgment. But if not a line was published of the material in our bulletins and we could, through the bulletins, stimulate the public utility companies all over the country

to deal fairly, honestly and straightforwardly with the newspapers we would be doing a tremendous service.

J. E. Mulholland (Fort Wayne, Ind.): Speaking for my own situation and community, I am representing ten different cities, the largest probably 100,000 population, the smallest 5,000 population. The city editor of the city of 100,000 population told me two years ago that he received regularly the bulletin from our committee on public utility information, of which I happen to be Vice President, and that as regularly as it came into the office he consigned it to the depths of the waste basket. In the town of five thousand population there is not an issue but what there is one particular article clipped out of that bulletin and published in the paper. In the town of 30,000 population the editor has frankly said to me, "There is nothing in there but propaganda. I never expect to publish one word of it, and if you want any of it published you will pay for it."

I believe that the various publications that are put out by the committees on public utility information could be very materially improved and that they could in time occupy such a position in our business as would not cause an editor in a city of one hundred thousand population to say to me, "Unless you specifically want me to publish a certain article that is there I always throw them in the waste basket."

James M. Bennett (Philadelphia, Pa.): The gentleman from Indiana has criticised the work, as I take it, of some of our committees. I am here to defend them. It seems to me that these men so far have done the best piece of publicity that has ever been produced in this country. I served twenty odd years in the newspaper shop and I believe I am qualified to speak on that subject.

S. E. Mulholland (Fort Wayne, Ind.): I do not want to be misunderstood. These committees on public utility information have done a wonderful work, and I agree, a very remarkable work, and I take off my hat to them, as I believe every other gas executive in the country does. But I believe that, in view of the fact that some of their matter is characterized as propaganda, that there is an opportunity along constructive lines of criticism to say: "Gentlemen, I believe you can do better." That is my point exactly.

Alfred Fischer (Ann Arbor, Mich.): In the matter of the editors that Mr. Mulholland cited, his contact with those three men and possibly with all six in his operating territory is merely typical of what we get all over the country in all of the states.

I have had some experiences within the last few months that might be illuminating in this discussion. The type of thing which in these Indiana cities has been characterized as pure propaganda, I think, will fall under the general sub-division of information material, things which we put into those bulletins because we think that they carry information to someone. We are partially right because someone does use to greater or less degree everything that we send out.

We are all striving not merely to clear up the public mind on certain technical engineering and chemical operations which are not generally understood and which cannot be understood by all laymen, but we are also trying to establish the public utilities as having an ideal of service, as being administered by a lot of resourceful fellows who have the in-

terest of their communities in mind. I want to give two illustrations of concrete publicity work which I did this summer in which I attempted to contribute directly to that fact.

One of them had to do with a comparatively simple thing and that was emphasizing the various hazards connected with amateur installation of radio sets. We got any amount of publicity about that. The radio editors were glad to use it and almost every paper ran something about radio hazards.

Another instance had to do with something I sent out about the first week in August, calling attention to the Schaeffer prone pressure method of resuscitation. We urged that someone in each Michigan summer camp should demonstrate the prone pressure method of resuscitation and if they could not get assistance in any other way to call upon the local gas and electric company. We got any number of letters and personal calls from interested individuals asking us to arrange the local contact and letters arrived from utility men stating that they had been called on and had made good on the assignment.

Those things never get into a bulletin because they are outside the pale of newspaper publicity. I do not care what piece of information we might send out, whether it be about labor costs or the price of gas oil, or building and expansion plans, someone is going to brand it as propaganda or as free advertising or as press agent stuff. There is no more unanimity about such matters in the newspaper field than there is in the minds of the executive with whom you work and I believe that point should be borne in mind. I think, also, that there is not an information director anywhere in the country but who gets out as much as he can and feels he ought to get out about four times oftener than that, not merely to make the contacts with local editors, but also to extend his acquaintance with utility managers.

W. P. Strandborg (Portland, Ore.): The idea that I have on this state committee work is that the personal contact with your local public utility men and from them directly to the newspaper editors is the one foundation upon which the success of your information bureau must be based if you are going to get anywhere. I think that some of us have overlooked the fact that the fundamental thing back of the bureau work is that you must have a definite objective in mind and shoot at that all the time.

If you do not have the personal contact with the newspapers and let them know that they can have confidence in what you produce and distribute, how do you know that you are making any headway? If you find that your utility company is in "Dutch" with the local public and the local press, I maintain that it is one of the most serious responsibilities for the director of the state committee to go in there and find out what he can about that situation and prevent the general public from placing all utilities in the category of that one company.

We had a situation of that kind where I come from, where, because one of the major utilities was in wrong, the people, under the operations of our beautiful recall system, threw out two public service commissioners who had had a fairly good education in what they should do to protect the public as well as to help utilities earn an honest living. All of us in the state of Oregon suffered because one company was in wrong. I think if we had had a committee in that state at that time we could have started some

kind of a backfire that would have saved something out of the situation.

I want to show you what the idea is I am working on in Oregon. I am going to make a personal call on every editor in the state of Oregon before I ever send out a scrap of information to the press,— at least to all of the newspaper editors in the territory served by the companies who are members of the committee. You have got to establish yourself with those newspaper men before you can have any assurance that your stuff will go over at all, no matter how good it is. The work of this committee must be predicated upon confidence always and they must know the source of this information.

I am going to know some of our newspaper fellows so well that I can call them by their first names, and when I send this information out to them I am going to send along a personal message. If they have not got sufficient confidence in Bill Strandborg they are not going to have sufficient confidence in the state committee, and that is why I say you have to stress the importance of the personal contact.

I know in the big states you have hundreds of thousands of editors and have bigger communities and the editors are more hard boiled and harder to reach. But I am telling you what I am doing in the state of Oregon where we only have 273 newspapers. But I think the personal contact is the one thing that is going to help you more than anything else. If there is anything like an even break on the stuff that you send out you will get the best of it.

J. S. S. Richardson (Philadelphia, Pa.): So far as establishing contact in the various newspaper centers is concerned, we have already started that in Pennsylvania and we are getting pretty good results. But you cannot reduce newspaper editors to the least common multiple and expect all to agree with you. They simply will not do it. You will find editors in small towns of Pennsylvania who say, "It is a lot of bunk. We can't use it; it is nothing but propaganda," when the Pittsburgh and Philadelphia papers are using the stuff considerably. On the other hand, the small town papers grab all sorts of matter that the big town papers will not use. And as I see it, most of the committee directors are endeavoring to feed the papers of various sizes in every issue of the bulletin. You find articles which the small town papers drop and the large town papers use and vice versa.

The attitude of some executives of public utilities toward publicity and the directors of those committees is very much similar to that of the actress who hires a press agent and roars because she does not get a column in the paper every morning. You cannot get all the papers to use that stuff piecemeal as it comes along, they will not do it, and you might find an editor of a paper in a good sized town who will throw the stuff away and sometime in the near future he may be relegated to the background and another fellow takes his place who will use it. All editors do not think alike.

I have worked for a number of them. I have been one myself for a great many years. They are a hard boiled lot, most of them, and some of them are comparatively human. But they have a pretty good idea of news values and if they are not using the stuff in a section of the state it is up to the committee director, I think, to go out there and find out why. Mr. Bennett, the secretary of our committee, and I go to vari-

ous sections of the state of Pennsylvania. We, through mutual friends, generally invite the editors of the papers in that locality to luncheon or dinner. We let them do most of the talking. We find out where they have kicks against the stuff if they have any. First of all, we sound out the general situation there through the medium of the executives of public utilities in that district. We find out from them what the general situation is, and then we take due notice thereof and govern ourselves accordingly. We are getting pretty good results that way, but you can not expect to get the stuff into all the papers of the state. Nobody can do it. No organization ever can do it.

H. C. Abell (New York, N. Y.): I am afraid this discussion is anticipating the meeting of Thursday afternoon. Along that line, I think that suggestions along the following lines should come from the directors.

1. Contact with public utility executives. How and to what extent should that be carried on?

2. Contact with the newspapers. To what extent and how best to accomplish it?

3. To what extent should the director attempt to lead the executives and how far should the executives attempt to lead the information bureaus' work? I think that is very important.

4. How can the relations between the executives and the information bureaus be best organized for constructive development of the work?

5. How should all public utility employees be organized as assistants to the information bureau?

I would like to make those five suggestions as a basis for consideration by the directors for Thursday afternoon.

The Chairman: They will be listed, Mr. Abell, and you will be put on the program to start the discussion.

H. M. Lytle (Chicago, Ill.): It seems to me in all of this discussion that the very point I raised at first, which apparently was overlooked, is the base of most of the discussion. The work of the state committee is not generally understood, nor is its purpose understood, nor the extent of the organization understood, nor the position of the director understood.

If you will recollect, I said that the director was merely the machinery of a state committee and the state committee is composed of utility executives of the state, and naturally the tail does not wag the head. The head is the advisory committee. The tail is the director and he does as the head directs him to do. In other words, he is trying to keep his committee going along the path that it should be going along.

Fortunately, I have no trouble in Illinois in that respect because I have reasonable men to deal with. But this plan that you are talking about here is rather confusing to me. Four years ago when I started in this work there was no plan and there is no plan yet as far as I know. I am working about as I did in the newspaper office. I do the thing that I should do that day and tomorrow I do the thing that I ought to do, and overnight I anticipate what I ought to be doing tomorrow.

The Chairman: Is there not an analogy here where the chairman again may be permitted to make a statement? The state committees are furnishing a general service for which the companies pay with their contributions, and if the local company does not utilize that service by cooperating with it and making

use of it in the local town as he may, the same as utilizing engineering service or lawyer service or any other service, is not some of it up to him? Is not that his fault?

J. B. Groce (Boston, Mass.): May I go on record simply to say in regard to New England that as far as our committee is concerned, comprising twenty-two members, we never enter into any controversial discussions of any sort. At the very beginning, at the very establishment of the bureau, that policy was laid down and has been carried out until today.

H. C. Abell (New York, N. Y.): The reason I bring up the various questions is that I have found from my experience in different states in which we operate that an executive, because his company happens to make a contribution to the committee, thinks he owns the director and that that director should do just as he dictates. If he wants to get something into his local paper relative to his company he thinks the director should get it in. I think a line of demarcation should be drawn.

Benjamin E. Ling (Cleveland, Ohio): Does not this discussion this afternoon, while it clears the atmosphere, show you one big point,—that you cannot lay down any plan or set any specifications for operating all the state committees exactly the same way? You cannot do it. I can get a lot from hearing the talk here this afternoon about what I ought to do in Ohio, but many of the things discussed here would not do me a continental of good in Ohio; I would not or could not use it. The job does not consist only in getting pieces into the newspapers. If I thought that was my job I would throw it up in a minute. My job sometimes consists of preventing the newspapers from publishing things. That is the reason weekly newspapers are sent out, to try to give the man who guides or has the chance to form public opinion, information on what the utility business is. I do not care whether they print it in the newspapers or not. I do not think anybody should care. Mr. Abell and every other utility executive here is well pleased if the newspaper would not publish anything about their business. What he does not want them to do is to publish something antagonistic about it. If they are going to print anything at all let them print the right thing.

I think each state director should get the idea that it is his job just as much to bring the various parts of the industry together as to get the specific man assigned to the individual companies to go to the newspapers. The personal contact cannot be displaced by anything else. We have got to be in contact not only with newspaper editors but with the executives of utility companies. We have got to stimulate the utility executives, stimulate the utility employees to learn more about the business, and if we are doing that and not confining ourselves to one narrow field of operation in this work, I think we will get further.

The Chairman: One of the other points in which I am taking upon myself to exercise the initiative, impinges on questions raised in this discussion about more national effort or help from the national association. I think it is, at least, in the minds of a good many of the directors here, that considerable can be done and should be done to increase the output during the year from national headquarters of matter that would be useful to and usable by state committees.

If you will pardon the personal reference in that matter, I was rather closely

in touch with that sort of thing during the year as chairman of this section, and I think the groundwork has been laid in the office of the headquarters to rather extend the assistance that headquarters has been able to render to state committees and to extend that during the coming year. But there is probably opportunity to do considerably more. So the suggestion I have to make and what I am going to take it upon myself to do is to appoint the directors of the state committees who are present—Mr. Groce, Mr. Lytle, Mr. Ling, Mr. Mellett, Mr. Fischer, and any others who are here and I do not happen to see at the moment—to constitute themselves a committee to put down concretely on paper between now and Thursday some specific recommendation as to certain kinds of information that they would like to have headquarters furnish during the year to make the work of the state committees more effective for the gas industry generally and for individual gas companies in every state where there is a state committee.

I would ask those gentlemen to please consider that they are appointed a committee to do that thing and we expect a report from them, at least at the Thursday meeing. That is all that we have on the docket.

(Mr. James M. Bennett assumed the chair and presented, on behalf of the directors of committees on Public Utility Information, to Chairman B. J. Mullaney, a set of cuff links.)

ADJOURNMENT

SECOND SESSION

Wednesday Afternoon, October 17, 1923.

(During the reading of the Chairman's Address, Mr. J. M. Bennett, Vice-Chairman, assumed the chair.)

ADDRESS OF THE CHAIRMAN

Bernard J. Mullaney, Chicago, Ill.

The Publicity and Advertising Section of the American Gas Association has had, on the whole, a good year. While more was planned than was actually done in some directions, in others the results have exceeded expectations.

There will be no attempt in this report to tabulate results in detail, because tabulation, even if it were feasible, would unduly emphasize facts of lesser importance and obscure the more important. Advertising and publicity results, in their more significant aspects, are not of a kind that can be weighed, measured or expressed by a plotted curve. But, in so far as results of the year can be reduced to specific terms, they should offer to all who have had to do with them—in other years as well as during the 1922-1923 period—abundant inspiration to further constructive effort.

In considerable measure, the record of the passing year has been a harvesting from plantings by previous administrations of the section: pioneering in a region not only unexplored but largely unregarded, in so far as the manufactured gas industry was concerned, until the Publicity and Advertising Section was organized a little more than four years ago.

Convention Program Reflects Section's Work

Something of what has been done in those years is reflected in the Section's share of the program for this fifth annual convention of the American Gas Association. As you may see there, the Section advances year by year from the theoretical to the actual; from "we ought to" talking to *doing*. Our sectional sessions, plus the Section's contribution to the general-session program, provide *practical* papers, addresses and discussions, by *practical* men, on *practicable* ways and means of getting *practical results* that are of prime importance to the industry and to every company, namely:

1. Better Public Relations.

2. Larger Sales of Gas and Goods.

3. Increased Income and More Profit.

4. More Satisfied and Efficient Employees.

5. Greater Freedom in Developing Company Business.

Therefore, it is respectfully submitted that the particular kind of association work represented by the Publicity and Advertising Section is entitled to unquestioned recognition, now and hereafter, as of major importance in the stabilization, development and extension of the manufactured gas industry.

Three Main Achievement Items

More specifically, the work of the year and its results are separable into three fairly distinct items, although in consequences, as in all other respects, the three are closely inter-related. They are:

1. Closer co-operation with State (sometimes regional) Committees on Public Utility Information (or information bureaus) of which there are now 25 operating in 34 states: that is, fuller utilization of the best machinery yet devised for furthering intelligent understanding of public utilities by the general public, with consequent favorable reaction upon legislative, rate, regulatory and *financing* problems.

2. Advertising by gas companies beneficially increased and the influence of it enhanced by extension of the A. G. A. Advertising Service and by affiliation, through the Public Utilities Advertising Association, with the Associated Advertising Clubs of the World, which organization bears about the same relation to Advertising, in all of its aspects and interests and ramifications, that the American Gas Association bears to the gas industry, or the U. S. Chamber of Commerce to the commercial bodies of the nation.

3. Newspapers and other publications brought into better understanding of, and relations with, the industry: important because, generally speaking, newspaper attitude (friendly, unfriendly, or just indifferent) toward the industry is incontestably a main factor in determining the attitude of the public; and that, in turn, determines the attitude of, and to a large extent action by, legislatures, commissions or other regulatory bodies, and *investors.*

The direct value of these results to our industry and to every company in it, even to those that are doing little to help themselves—dollars and cents value—is no longer debatable. Better business conditions and better business—*increased sales of gas and of merchandise and appliances, fairer and more stable rates, surer net return and easier financing*—all these are following improved public relations as surely as the day follows the dawn. Hence, the desirability of continued constructive effort in the particular fields which have just been described.

Getting Much for Almost Nothing

Closest possible co-operation with State Committees is important because these agencies do for the industry, and for participating companies, much that the industry and the companies cannot do for themselves; and (a not negligible consideration) they do it for almost nothing when the cost is compared with result-values. The point is this:

Public enlightenment on the problems of the industry and of its companies is still needed. There is not enough money in the industry to pay for getting all of it adequately done by means of paid advertising alone. Doing a considerable part of it is the function of State Committees. They are making good at it, wherever they are receiving proper co-operation, because they are (and this cannot be said too often) the best machinery for doing it that has been as yet devised. Their history is proof.

The first state committee was formed

(in Illinois) only four and one-half years ago. As the Plan made good, it was taken up elsewhere; and the 25 committees operating in 34 states are all following the same general plan.

Still closer co-operation next year with State Committees by the American Gas Association, and especially by member companies in states that have committees, is desirable for two specific reasons, namely:

1. In several states other public utility industries are getting relatively more out of the state committee plan than the gas industry is, simply because they are making better use of it.

2. The ground work has been laid at A. G. A. headquarters for doing things that will make state committee work still more effective for the gas industry than it has been, if this ground work is consistently developed and extended by due co-operation from member companies.

Other Concrete "State Committee" Profits

This closer co-operation is a job for chief executives and for lesser officials as well. Intelligent publicity work for the gas industry is distinctly not alibi manufacturing; it is anything but that. Information—accurate, comprehensive information—is the very body and soul of it. *Up to date statistical data and business development information is especially useful and usable.*

Hence, it would seem that lesser officials and especially technical men—engineers, chemists, accountants—should want to do their part in "feeding," and co-operating with, state committee work. As personal return for their interest, it is conceivable that they may thus gain a recognition of their importance in the industry which, they sometimes complain, is now inadequate.

This co-operation will *pay* in specific as well as in general return. Instances are on record in which state committee directors have been very helpful to individual companies in delicate public relations situations, when they have been permitted to be "of counsel." For be it remembered, the competent director of a state committee is a specialist in a technique that is as definite as that of the chemist or the engineer.

Advertising—Some Points Easily Overlooked

Upwards of 225 member companies, nearly one-half of the Association membership, now use the A. G. A. Advertising Service. This is a fifty per cent increase for the year. The service has also stimulated individual advertising by member companies. Inquiry has developed that in various states gas company advertising has increased from twenty-five to two hundred per cent during the year.

The significance of this, especially in beneficial reaction upon the industry, goes farther than the mere statement implies. All the world recognizes the place of advertising in modern business. Consistent employment of it tells the world that ours is an on-its-toes, up-and-coming industry, and not one that "has seen its best days," as Babson once had it. There is real money-value in that.

By advertising *Advertising,* the section promotes realization that the commodity, gas, and gas service, as well as merchandise and appliances, can be *sold* into broader use and better understanding, as chewing gum, men's clothing and motor oils are sold. Obvious fields for "cashing" this realization, to name only two, are: (1) advertising to extend the industrial use of gas, and (2) advertis-

ing to hold what we have against competition, as electricity, for example, which is in some places becoming a real competitor for the important cooking load.

Where the P. U. A. A. Affiliation Comes In

By affiliation with Organized Advertising through the Public Utilities Advertising Association, which is a departmental of the Associated Advertising Clubs of the World, much as this section is a part of the American Gas Association, our industry is getting "in step," greatly to our advantage, with influences that are worth more than casual attention.

There are some twenty-odd of these departmentals (similar to our A. G. A. sections) and the associated clubs have upwards of 20,000 active members. Each departmental represents some distinct advertising interest: Newspaper Executives, Agricultural Publishers, Trade and Technical Papers, The Religious Press, Motion Pictures, Financial Advertisers, Community Advertisers (chambers of commerce, business men's associations, etc.), Church Advertisers, Industrial Advertisers, Retail Stores and a dozen other groups. Compositely, these federated groups represent Advertising in all of its ramifications and the federation functions actively both to advance and to protect the interests of members.

Being "One of the Family" Helps

One typical activity of this federation is the Better Business movement and the resultful campaign against fraudulent stock company promotions, which should be of some collateral interest to all of us who are concerned with Customer Ownership; another is an active legislative committee; another is the promotion of the community-of-interest spirit among all legitimate businesses, something distinctively advantageous to our industry.

Becoming "one of the family" in such activities would seem to be a positive gain, to say nothing of many others. To name only one of the others: it is something to be in a position, by direct contact with agencies that are talking to the entire public day by day, to promote the thought that Public Ownership contains no nourishment for any business that touches Advertising—publishing (of newspapers or other periodicals), printing, photo-engraving, lithographing, bill posting, paper and ink industries and so on.

Newspaper Relations—Progress and Some Opportunities

Better understanding of the industry by the press of the country, and therefore better relations with it, have been advanced primarily by the State Committee and the Advertising activities already discussed, plus personal contact with newspaper association work. This is not to say or imply that newspaper attitude has been or can be affected by our advertising; we have no right to expect that; when we buy advertising space we get full value for our money and are entitled to nothing more; but it is to say that our general attitude and policy, as reflected in the activities mentioned, has produced favorable reaction in the newspaper field.

The representative and comprehensive newspaper organization of this country—from coast to coast and north from Mexico—is the American Newspaper Publishers Association, with a membership of several hundred newspapers, all the best dailies. Another important one

—probably the most important next to the A. N. P. A.—is the Inland Press Association representing the leading papers of fifteen middle western states and a part of Canada. Both have specifically recognized the work which this Section of the A. G. A. has been promoting.

The Advertising Bureau of the A. N. P. A. has advised its members to take the initiative in helping us solve some of four advertising problems; to get in touch with local companies that may be inexperienced and inexpert in advertising and help them work out effective and profitable plans and copy. Co-operation of this kind has been established during the year in several places, and it offers abundant opportunity for further attention. The Inland Press Association has recommended to its members hearty co-operation with our industry's policy as reflected in the activities previously mentioned.

"Velvet"—And More to Come

All this, mark you, and more to come as we continue this enlightened policy, is "velvet." For advertising *pays* on its own account, and opportunities for gas companies to make it pay are almost unlimited, entirely apart from use of it in selling merchandise and appliances.

To illustrate. The public has had gas service a long time. It is an old story—taken for granted—although the present generation does not know much about the significance of it. ADVERTISING gas and gas service is the logical way to counteract this and check tendencies to "try" something else, electric cook stoves for example. Then the expanding opportunities for gas in the industrial field—that is a situation ready made for profitable advertising.

The more consistently and intelligently gas companies thus employ advertising, the larger the crop of public understanding and good will; and that, it is respectfully submitted, never can be too large. Respect for the industry and, conversely, the industry's respect for itself, are enhanced. Among those agencies which have most to do with influencing the public opinion that rules our business, we gain in two ways: on one hand we are lifted from the class of businesses that are considered the natural prey of "special edition" and "Charity" advertising solicitors; on the other, we escape classification with the "space grabbers" and "free publicity schemers" who are anathema in every newspaper office.

Some Recommendations and Acknowledgements

The foregoing is all predicated on dealing with things as they are, not as some of us may think they ought to be. It points the way to practical and time-tested ways and means of advancing the industry. Continued promotion of the work already well started, as described, is obviously the fundamental recommendation for the work of this section in the immediate future.

The industry is full to bursting of material that is *news,* when properly presented, and helpful when printed. To name but a few sources:

There is the smoke nuisance and the place of gas-fuel in solving it. There is the coal question: a searching all over the world for relief from dependence upon raw coal for general fuel purposes. (Think if the iron and steel user had to take the raw ore and do his own converting as the heat user has to convert raw coal into gas and ash before getting

his heat!) There is the injustice of the prevailing rate system in its discrimination against the customer of small means, the workingman and his family, in favor of the occasional "convenience" user of gas, because the uninformed think "small users" and "toiling masses" are synonymous. There are the interesting uses of gas in the arts and the industries—full of colorful material.

Abundant profit to the industry—money-profit—will follow utilization of these opportunities, backed by company use of advertising as practically all modern and successful businesses use it. That is as certain as death or taxes.

Consistent use by member companies of the slogan, as recommended by the Manufacturers Section and adopted by the Association—"If it's done with heat, you can do it better with gas"—is urged. The value of a slogan grows with use of it. This one has proved itself where consistently used.

This report would be incomplete without acknowledgements to the headquarters staff of the Association, and especially to Col. Oscar H. Fogg, Secretary-Manager of the Association, and to Mr. Charles W. Person, secretary of the Publicity and Advertising Section. Whatever has been accomplished by the Section has been made possible by their hearty co-operation and efficient assistance.

REPORT OF THE NOMINATING COMMITTEE

The secretary presented the following report of the Nominating Committee, For Chairman—James M. Bennett, Philadelphia, Pa.; For Vice-Chairman—Frank L. Blanchard, New York, N. Y.

(Upon motion duly seconded and carried, the report of the Nominating Committee was accepted, and the secretary, as instructed, cast one unanimous ballot for the election of the officers as nominated.)

REPORT, PUBLIC UTILITIES ADVERTISING ASSOCIATION

W. P. Strandborg, President, Portland, Ore.

Perhaps it would be better to start my short report by saying that the Public Utilities Advertising Association was created about a year ago. Previous to that time the public utilities advertising men had no clearing house or place for self expression within the conventions of the utility associations, and as advertising men they had no place within the official deliberations of the Associated Advertising Clubs of the World. By the organization of this movement we accomplished the double purpose. We also have set ourselves fairly and squarely back of the doctrine that the public utility industry is a powerful advertising and advertisable business. We have also set ourselves fairly and squarely behind the doctrine of "Truth in Advertising."

To begin with, I desire to take up the question relating to a plan for the investigation of public ownership in Europe. That proposition was, unfortunately, not presented in such a manner or elaborated to such an extent that the merits were fully set forth in understandable fashion. The inevitable result was that it aroused a great deal of unfavorable comment and considerable controversy on the part of public utility executives and managers largely because it involved the major policy of those utilities.

Now, gentlemen, I am willing to admit that the proposition as originally presented will have to be carved to pieces and subjected to a major operation, but I think out of it we may be able to find something constructive to work on. The proposition was presented because I felt that it afforded an opportunity for the advertising men of the public utility industry to go abroad at the time of the next convention and find out at first hand something about the public ownership movement in its various aspects in continental Europe and in the British Kingdom.

I was moved to make that proposition because a few months ago the president of the State Federation of Labor in my own state told me that there was a definite plan on foot on the part of the American Federation of Labor to adopt

a resolution committing that organization to a general program of public ownership of all public utilities. That he was a sound prophet was demonstrated less than two weeks ago when the American Federation of Labor in convention assembled in my home town of Portland, Oregon, did adopt, by unanimous resolution, a program committing the six million members of organized labor to a program of public ownership of all public utilities.

That is serious, because organized labor votes as a unit and the women folks and members of the family vote the way the head of the house goes, if that head is identified with organized labor. There is in that resolution, gentlemen, a potential voting power, I would say, of not less than ten million votes if cast as that resolution was presented and adopted less than two weeks ago.

As a second reason for presentation of that proposition, we all know that there is a movement in Congress, led by Senator McKellar, to nationalize the American railways. He has planned, as I understand it, together with the supporters of that movement, to push the project at the coming session of Congress, and you men and women know as well as I do that it will not be a very long step from the nationalization of the American railways to the nationalization of the other public utilities of the country.

A third reason for presenting that proposition lay in the fact, which seemed rather remote at the time, but I believe is gathering stronger significance, that a movement which was started by some members of Congress to secure a flat five cent fare for the railroads of the District of Columbia, had for its ultimate purpose the abolition of public service commissions in the various states and returning to a general policy of home rule.

Now, then, I did not present that proposition from the standpoint of a man who is sending up an S O S distress signal, but rather from the standpoint of one who wanted to erect some lightning rods on his barn to that he would be ready if or when a storm should come. That was the purpose of the presentation of that proposition and I submit to this conference if there is not enough material or if there are not enough data to gather momentum at the present time—to warrant some serious consideration of a plan along those lines.

Of course we could not undertake, in the short time that we would be in London to attend that convention, to make a thorough technical or even a non-technical investigation that would cover all the ground. But I do say this,—that the advertising and publicity men, the general group of public relations men if we want to include all three phases, are the ones who have been in the habit of telling the story of the public utilities to the public, and if there comes a time when public ownership is a live and imminent issue it will be incumbent upon the advertising men of the public utilities to tell the story of public ownership to the public again. If they are to be fortified with first-hand information I see no better opportunity offered than to have our Association properly equipped with a delegation to go abroad and gather such information and establish such contacts on the other side as will furnish us with the proper tools to work with if we have to face a general program of public ownership in America.

This delay on the other side has pre-

vented our organization from getting into any definite action with reference to our convention plans over there. We will have two distinct committees working in the interests of the London delegation. One will have charge of the program that we will put on and the other will have charge of working up an attendance. I have talked with quite a number of our members and they agree that we should limit the number of our delegation to perhaps twenty or twenty-five and organize it carefully.

As to the work, that can be carried on and is being carried on through co-operative effort of other associations and through our own members and close contact with the directors of the state committees. We are able to convince a large number of companies, that do some advertising but do not have advertising managers, that it is a good thing to establish advertising departments and to use advertising on a permanent and systematic basis. I say that because the records show that the number of companies doing that is constantly increasing. How much credit for that is due to our own members and how much of it is due to the national utility headquarters or to the state committees I will not undertake to say, but it does not matter. We are accomplishing the purpose.

Then again, one of the important fields is the smaller company which does not do any advertising at all. Those are the ones to whom I think we should give the closest attention; and those companies, I believe, will receive a great deal of benefit through the activity of some of the newspaper associations with which we have already established contact.

Through co-operation with the service department of Printer's Ink every member of the New York State Newspaper Association has been supplied with material which developed at our last convention in June. A large number of the advertising managers of the newspapers in the state of New York are doing missionary work with the public utility men.

Mr. Joe Carmichæl, the Director of the Iowa Committee, got in today, having just spoken at the meeting of the Inland Daily Press Association at Chicago. That association has promised, through its executive secretary, to work closely in harmony with us, and they, too, will be able to assist us through the same method that is being employed in the state of New York. Mr. Carmichæl told me a very interesting thing, too, which shows the relation of advertising and the importance of advertising through the state committees. He found that the newspapers which get local utility advertising are giving more space to the material which is sent out by his office.

Now that is merely an expression of human nature. In other words, while it may not sound like good doctrine to say that we should do that sort of thing as a cold-blooded proposition, yet it does follow that if the utilities do advertise in those papers regularly, those papers are going to take much more kindly to the information that is sent to them from the state committees. So you can see that if our Association is able to get a majority or nearly all of the public utility companies of the country to advertise regularly in the newspapers, we are going to have much less difficulty in getting our story over to the public through the press.

WHAT NEWSPAPER ADVERTISING HAS DONE FOR OUR COMPANY

ARTHUR W. HAWKS, JR., Consolidated Gas Electric Light & Power Company, Baltimore, Md.

MR. MULLANEY is responsible for the text—"What Newspaper Advertising Has Done for Our Company."

Suppose we approach it with two questions. A question is the first thing to ask when you want an answer. We are glad to give you our answers. You may not think they are the right answers, but for our proposition, we know they are.

Why does the Baltimore Gas and Electric Company Advertise?

It pays to Advertise.

Why does the Baltimore Gas and Electric Company advertise in the newspapers?

It pays better to advertise in the newspapers and costs less than advertising in any other way we know.

Now to continue the catechism:

How much of the Baltimore Company's advertising is done in the newspapers?

Nearly all of it.

Don't you consider other forms of advertising profitable?

Yes.

Then why do you do nearly all your advertising in the newspapers?

Because our advertising dollars go farther there and bring back more than any other place we put them.

To sum it all up, the Baltimore Company advertises because it pays to advertise, and the Company finds that it pays better to advertise in the newspapers than anywhere else.

We know that we do not know much about the possibilities of advertising in Baltimore. We know we have not fathomed its depths.

We believe that all good advertising is good for us and we have tried to resolve our problems into this single proposition.

> We advertise for one reason only,—for Profit. What, then, do we find the most profitable form of advertising?

There is no question in our minds that the answer is to be found in straightforward, North American use of newspaper space.

There is no royal road to success in public utility advertising, but you will find the advertising columns of your

home town newspaper the direct avenue to the minds of your customers. If you use this space to tell them the truth about your Company, to tell them in a way that will make them understand what you are doing for them day by day, that you understand what you have to do, why you have to do it, and how to do it, you will accomplish two things—you will make your Service more valuable to your Customer and your Customer more valuable to your Company.

If you are interested in knowing what you might say in your advertising, paste these quoted words of wisdom in your hat and read them now and then when you sit down to write your ads:

I had six honest serving men
(They taught me all I knew),
Their names are What and Why and
When
And How and Where and Who.

That's gospel. For the success of your advertising will depend on what you say; how you say it; where you say it; and how many times you say it. You have to tell it, and tell it, and tell it; and, your customer has to read it, and read it, and read it; and the more you tell it the more she will read it and the more she reads it the better off both of you will be. Just know what to say, how to say it, and say it in the newspapers—that's all. If you can't do it yourself get somebody to do it for you, but be sure he knows what he is writing about, and, make it enough worth while for him to let him know that you think what he is doing is as important as it is.

Perhaps you are wondering what is the basis for these assertions? They are based on individual experience. It is personal testimony given for what it is worth.

In Baltimore we have done a great deal of newspaper advertising. We believe in newspaper advertising. We count newspaper advertising space as a form of energy, so useful, so flexible and so cheap as to be almost in the class with the commodities we manufacture—gas and electricity. Not to make use of it would be to neglect an agency as useful to the utility as gas and electricity are to our customers. We are so convinced that it is doing so much for us that we are going to use more of it than ever.

There is a familiar illustration oft times used in connection with advertising, which, of course you will all recall. It is worth recalling.

Jones has one dollar.
Smith has one dollar.
They exchange dollars.
Then Jones has one dollar and
Smith has one dollar.

But if Jones has ONE IDEA
And Smith has ONE IDEA
And they exchange ideas
Then Jones has TWO IDEAS
and Smith has TWO IDEAS.

And the idea of exchanging advertising ideas isn't a bad idea at all.

This publicity parable suggests that it may perhaps be useful to state to you the principles on which we have built a campaign of newspaper advertising that has been of longer duration, broader scope and more helpful to the Baltimore Company than any other advertising it has ever done.

We have called the advertisements the "Good Public Service Series."

These advertisements constitute an illustrated tour of the Company by its Customers through the newspapers. Their dual purpose has been to make the ser-

vice more valuable to the Customer, and the Customer more valuable to the Company. They have appeared, at regular times, without interruption from April 9, 1922, to date. The cost has been about a cent a meter a month.

The phrase "Is Your Service Good? If Not, Please Let Us Know" has been printed over 31,000,000 times in the Baltimore newspapers.

The purpose and plan of the series of GOOD PUBLIC SERVICE advertisements which have been appearing daily in the Baltimore newspapers for the past 18 months can be summed up in three words —GOOD PUBLIC RELATIONS. The advertisements sought to accomplish this purpose, and we believe have accomplished it, by addressing the same message to two groups of people:

1—Our employes, *who serve*

2—Our customers, *who are served.*

The employes have been directly addressed through placards carrying the ads on bulletin boards placed throughout our plants: the customers have been addressed through that universal and indispensable medium, the daily newspapers.

The scope of the advertisements has been confined to the physical properties, useful in the public service; the personnel; the raw materials from which gas and electricity are made, and the investment by our customers in the Company's securities.

The purpose of the advertisements has not been to persuade, not to convert, but to *inform.*

The advertisements have sought to inform our employes of the magnitude of the Company's responsibilities to the people of Baltimore and to extend the employe's knowledge, beyond the limits of his special branch of work, to the physical operations of the Company as a whole.

The advertisements have sought to inform our customers of the comprehensive character of the service designed for their use, to acquaint them with the physical extent of the plants and distribution systems, and the duties of the men and women who operate them.

> To *inform* is "to acquaint with, advertise, advise, apprise, communicate, disclose, divulge, impart, instruct, intimate, make known, mention, notify, reveal, teach, tell."

Out of correct information comes understanding and from understanding comes confidence and without confidence there can not be GOOD PUBLIC RELATIONS.

We believe that the dissemination of accurate information, tersely told and graphically illustrated, could not fail to result in understanding which would be mutually helpful. Results have demonstrated that this belief was well founded.

Each advertisement has carried a single message concerning some important phase of the Company's ability to serve its customers, and has been accompanied by a single invitation to the customer—an invitation to complain of any poor service condition.

While building up our morale, while soliciting complaints for which we could apply a remedy, the series has entailed a relatively small expenditure and has had the effect of reducing, rather than increasing, our advertising expenditures. The reason for this is that the adver-

tisements have attracted attention, which is the first thing that any good advertisement must do. Though there is nothing new under the sun, we believe that this is an honest application of an old method to a new subject. It has, therefore, possessed novelty, and whereas we generally have to write so that "he who runs may read" a situation was created where, to quote an old friend, "he stopped running and read with interest." The attention which the advertisements have had is no doubt responsible for the fictitious notion that they have cost a lot of money. The fact is that they have not. The advertisements have told the truth and truth is stranger than fiction.

We plan to continue the series because we believe that we can still further improve our public relations and because we know that the information contained in the advertising is increasing efficiency. It is productive of operating economies through better team work, and is of large benefit to the consumer in suggesting ways to improve the conditions under which he utilizes gas and electric service. We seek to promote thrift and safety in the use of appliances, as well as convenience.

Good Public Service demands efficient production and efficient use. We must have the co-operation of our customers. The simplest way to get it is to deserve it and ask for it through newspaper advertising. Nobody will do it for you. Publicity is not automatic. The newspaper itself must advertise if it wishes to succeed, and the most successful newspapers are successful advertisers.

Good Public Service

THE public service of your Gas and Electric Co. never ceases. Every hour of every day it is supplying light, heat and power to meet the varying needs of 775,000 people.

Two things are necessary in order to give Good Public Service—efficient production and efficient use.

The company seeks the co-operation of its customers and systematically solicits complaints in order that it may remove their cause.

The meter is the point at which the company's property ends and the customer's property begins. At this point the problem changes from generation and distribution to utilization---from supply to use.

In the buildings of the 159,720 customers, supplied with gas, there is enough house piping to encircle the globe. All of this must be in as good condition as the company's distribution system to assure perfect service.

Hundreds of thousands of gas appliances are in use in these homes. Appliances of incorrect design, appliances improperly connected, appliances used for purposes for which they were not intended, appliances that are broken, all interfere with Good Public Service.

Similarly in the buildings of 107,202 customers using electricity a blown-out fuse, a loose connection, an overloaded circuit, an attempt to put an appliance to a use for which it is not suited---these and many other things can transform good public service at the meter into poor public service at the switch.

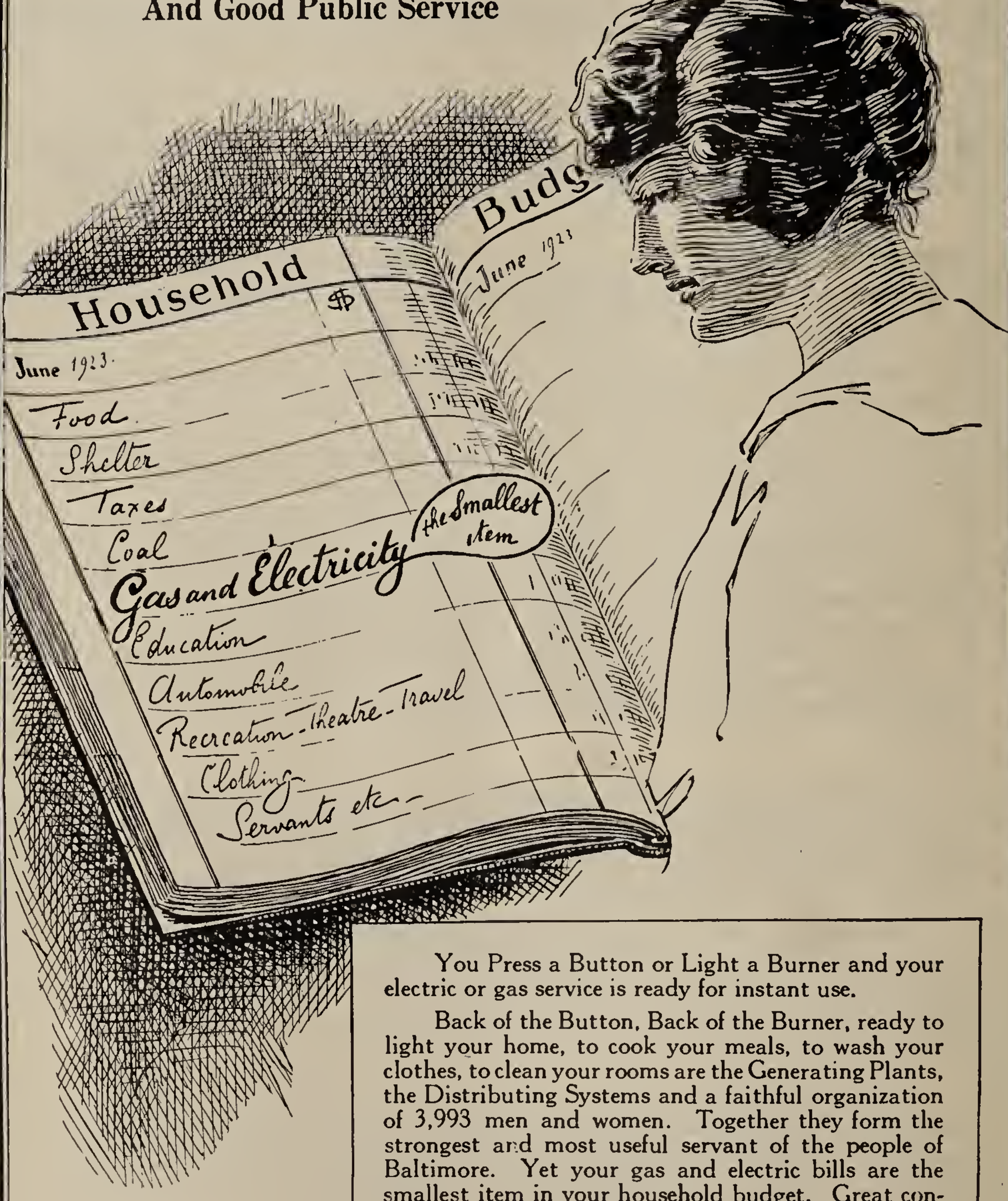
Your company maintains a General Service Department which is a clearing house for customers' complaints. It is whole-heartedly at the service of each and every customer of the company to see that the individual customer gets Good Public Service. No charge is made for investigating complaints and making minor adjustments.

Phone Plaza 8000 and ask for "General Service"

The Gas & Electric Co.

This advertisement will appear in the Baltimore newspapers during the week beginning March 25, 1923

Great Convenience At Small Cost And Good Public Service



You Press a Button or Light a Burner and your electric or gas service is ready for instant use.

Back of the Button, Back of the Burner, ready to light your home, to cook your meals, to wash your clothes, to clean your rooms are the Generating Plants, the Distributing Systems and a faithful organization of 3,993 men and women. Together they form the strongest and most useful servant of the people of Baltimore. Yet your gas and electric bills are the smallest item in your household budget. Great convenience at small cost and

GOOD PUBLIC SERVICE

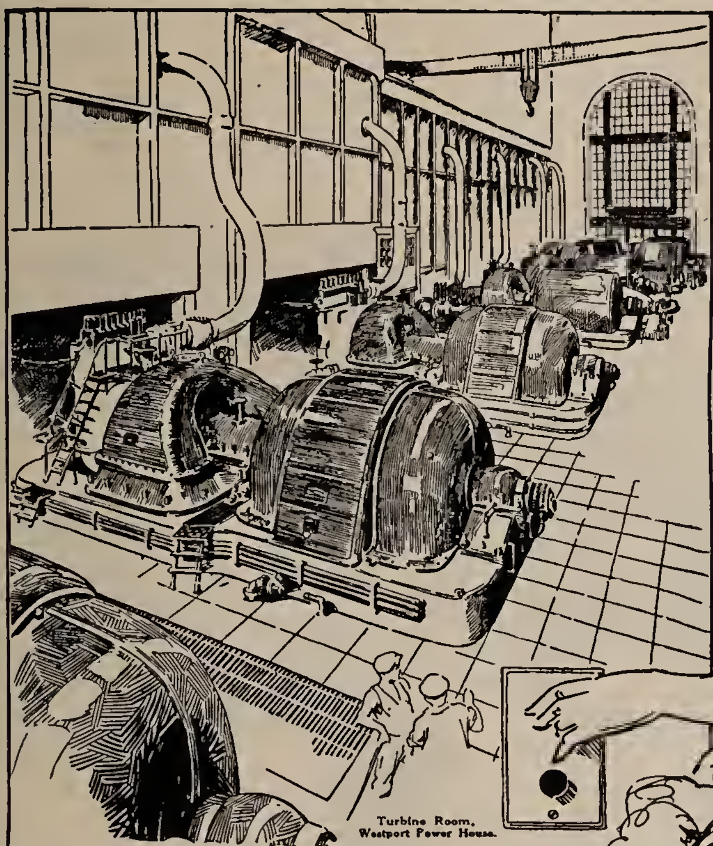
THE GAS & ELECTRIC CO.

Good Public Service

Is Your Service Good?
If Not, Please Let Us Know

Telephone Plaza 8000
General Service Department

This advertisement will appear in the Baltimore newspapers during the week beginning July 15, 1923



Turbine Room, Westport Power House.

You Press a Button, *AND*-

You press a button and your room is flooded with light.

Consider for a moment what is happening while the switch is on.

Great turbines in the power house have to generate the electricity the moment you demand it, and just that much more than they were generating before, for electricity cannot be stored. This requires more steam and the immediate use of more coal.

Then the current has to be transmitted, under streets and over highways to your home *instantaneously*.

You may have an electric button any place in your home which you may push at any time without notifying the Company in advance that you will need so much electricity at a stated hour; without giving a thought to its delivery or its measurement.

Electricity will transform night into day for you, and a house of drudgery into a home of ease.

Yet for the services of this greatest servant of man you pay for only what you use. It is the most useful and cheapest thing you buy.

The next time you press a button give a thought to the men working in the power house who respond instantly to your touch and to the men who have developed the electric art and to the investors who provided the power houses and distributing systems, which, in Baltimore, are dedicated to

GOOD PUBLIC SERVICE

THE GAS & ELECTRIC CO.

Good Public Service

Is Your Service Good?
If Not, Please Let Us Know

Telephone Plaza 8000
General Service Department

This Advertisement will appear in the Baltimore newspapers during the week beginning August 19, 1923

Complaints -

When our Customers tell us that their service is not right they render a valuable service by setting in motion actions that are bound to correct the trouble and result in mutual satisfaction. We consider the report of a complaint by a Customer to be co-operation of a fine and practical sort.

The General Service Department is a clearing house for Customers' Complaints. It invites complaints so that it may remedy them by removing their cause. It is wholeheartedly at the service of each and every Customer of the Company to see that the individual customer gets Good Public Service.

No charge is made for investigating complaints and making minor adjustments.

Good Public Service

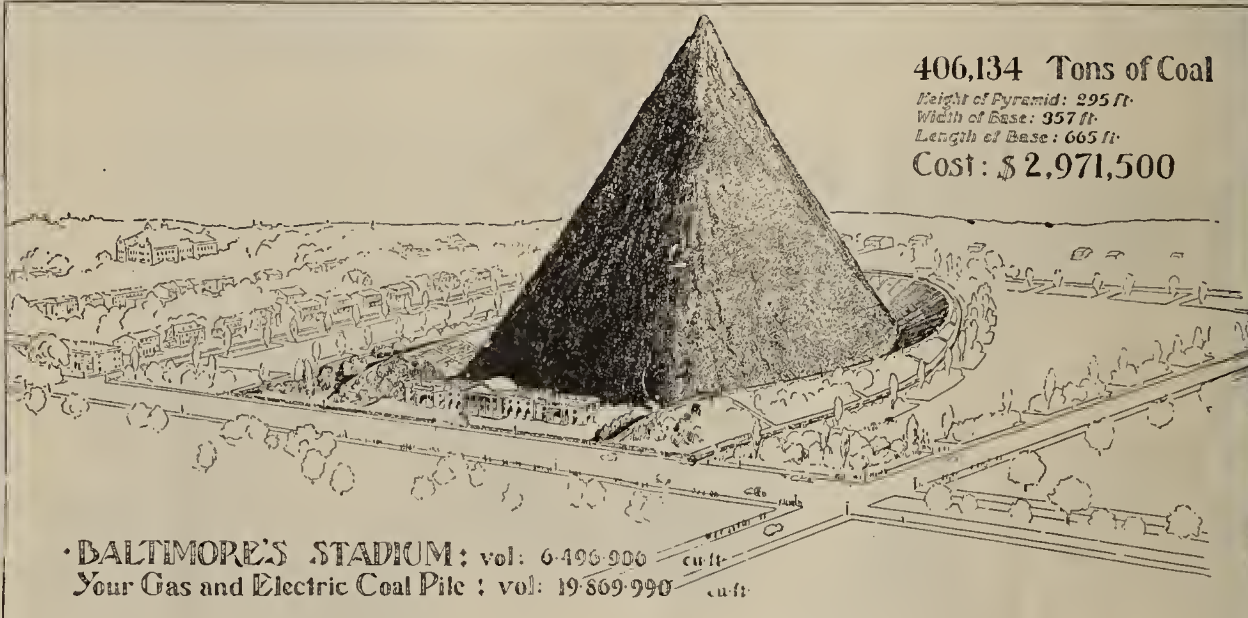
THE GAS & ELECTRIC CO.

Good Public Service

Is Your Service Good?
If Not, Please Let Us Know

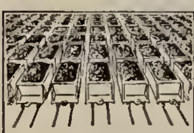
Telephone Plaza 8000
General Service Department

This Advertisement will appear in the Baltimore newspapers during the week beginning August 5, 1923

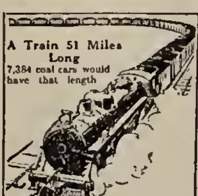


Baltimore's Gas and Electric Coal Pile for 1922 drawn to scale on the Architect's drawing of the Stadium.

A Coal Pile Three Times as Big as the Stadium Was Needed Last Year for Your Gas and Electric Service



7,384 Carloads
of coal required to make electricity and gas at your Company's plants in 1922



A Train 51 Miles Long
7,384 coal cars would have that length

Your Company burned 406,134 tons of coal last year to make Electricity and Gas for Baltimore. Of this 278,815 tons were used to generate electricity in the steam driven power houses, and 127,319 tons were burned at the gas manufacturing plant. The figures do not include the enormous tonnage used by the Bethlehem Steel Company at Sparrows Point, where part of Baltimore's gas supply is generated.

Your demand for light, heat and power required a coal pile three times as big as the Stadium.

In a year of coal strikes and transportation difficulties our plants were ready to serve you, *and serve you well*, at all times.

For every minute of 1922 we had to have ¾ of a ton of coal ready for use; for your service required 1112 tons a day and yet we used this coal so carefully and efficiently that we produced more electricity and gas from each ton of coal than ever before.

The year's coal supply required the movement of 7,384 freight cars of 55 ton capacity,—the equivalent of a train 51 miles long.

The coal is just one item. The plants, the distribution systems and a faithful, vigilant organization of 3,000 men and women were necessary in giving

1112 Tons of Coal a Day
was the average amount burned every day in 1922.

¾ of a Ton Each Minute
In 1922 the requirements averaged ¾ of a ton of coal for each minute in the year

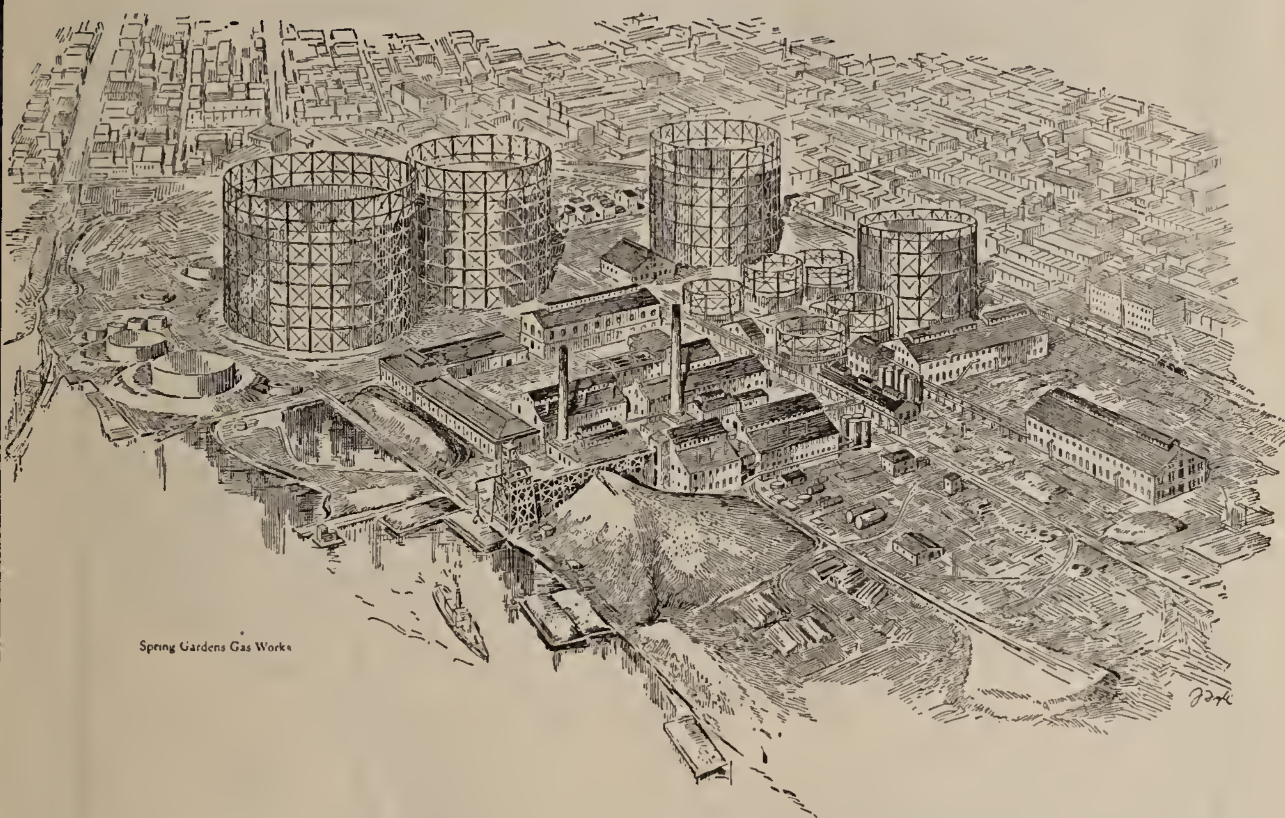
Good Public Service

THE GAS & ELECTRIC CO.

Is Your Service Good?
If Not, Please Let Us Know

Telephone Plaza 8000
General Service Department

This advertisement will appear in the Baltimore newspapers during the week beginning January 14, 1923.


Spring Gardens Gas Works

Gas Meter Shop at the Front Street Station

Suppose the merchant from whom you buy your household supplies bought a pair of expensive scales, had them approved by the State and put in your house to measure and tell you exactly the quantities of supplies being used?

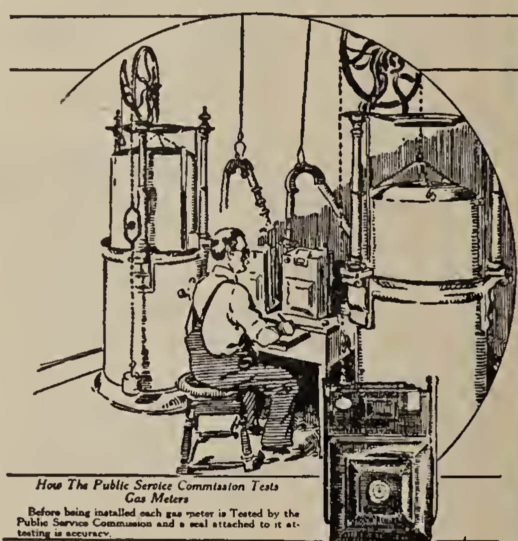
If he did he would be doing precisely what your Gas Company does when it puts the gas meter in your cellar.

There are 167,818 gas meters in use in Baltimore, each bearing a seal of the State of Maryland attesting its accuracy after test.

Besides performing an indispensable work these gas meters called for an investment running into millions of dollars.

Without this expenditure and the assured accuracy of the meter there would be no such thing as

Good Public Service



How The Public Service Commission Tests Gas Meters

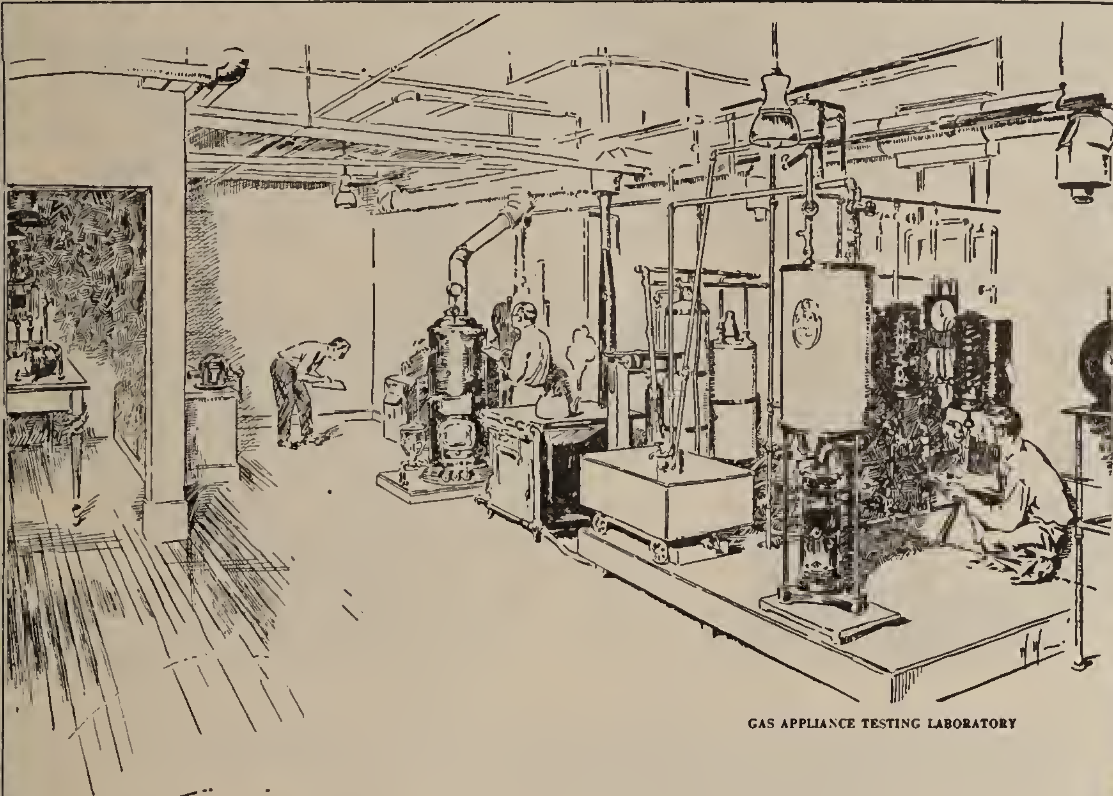
Before being installed each gas meter is Tested by the Public Service Commission and a seal attached to it attesting is accuracy.

THE GAS & ELECTRIC CO.

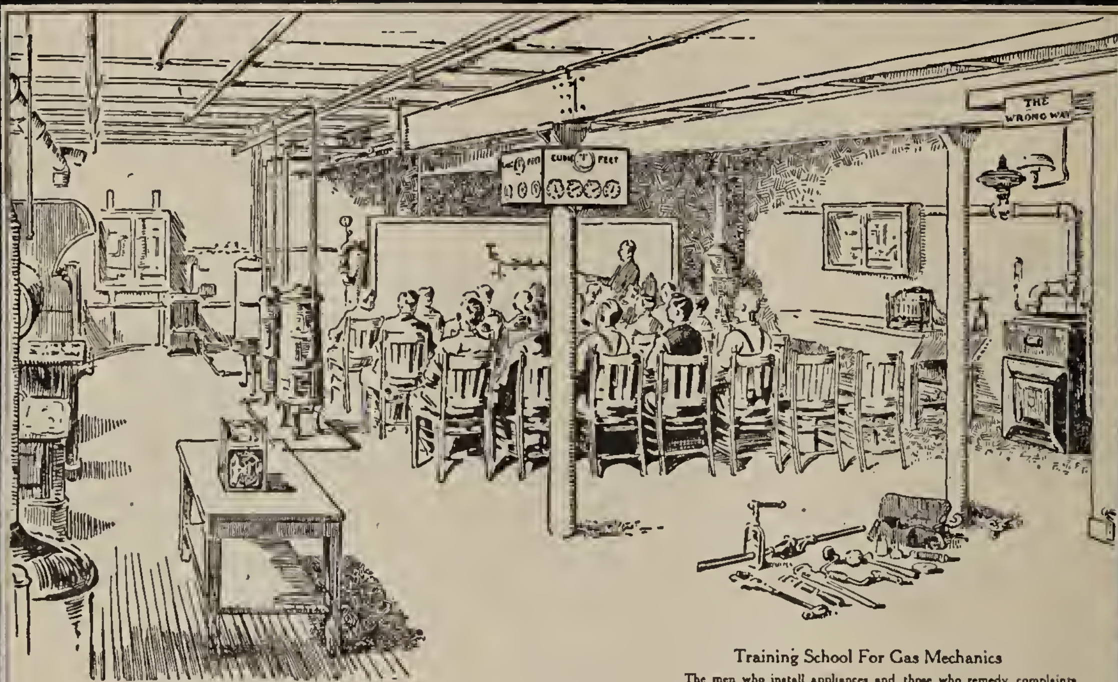
Good Public Service

Is Your Service Good?
If Not, Please Let Us Know

Telephone Plaza 8000
General Service Department



GAS APPLIANCE TESTING LABORATORY



Training School For Gas Mechanics

The men who install appliances and those who remedy complaints attend this school for gas mechanics, where they are taught the high standards of practice developed by this Company during a century of experience.

Good gas service demands the correct installation and adjustment of appliances.

Our customers' satisfaction from such service results in no small measure from the skill and interest of the men in the Gas Fitting Department.

Instruction and training are fundamental factors in creating the intelligent interest of the men who do this important work.

All of them have the practical benefits of attending a Training School maintained for this purpose at our Front Street Gas Distribution Station.

Another of the methods developed to insure

'*Good Public Service*

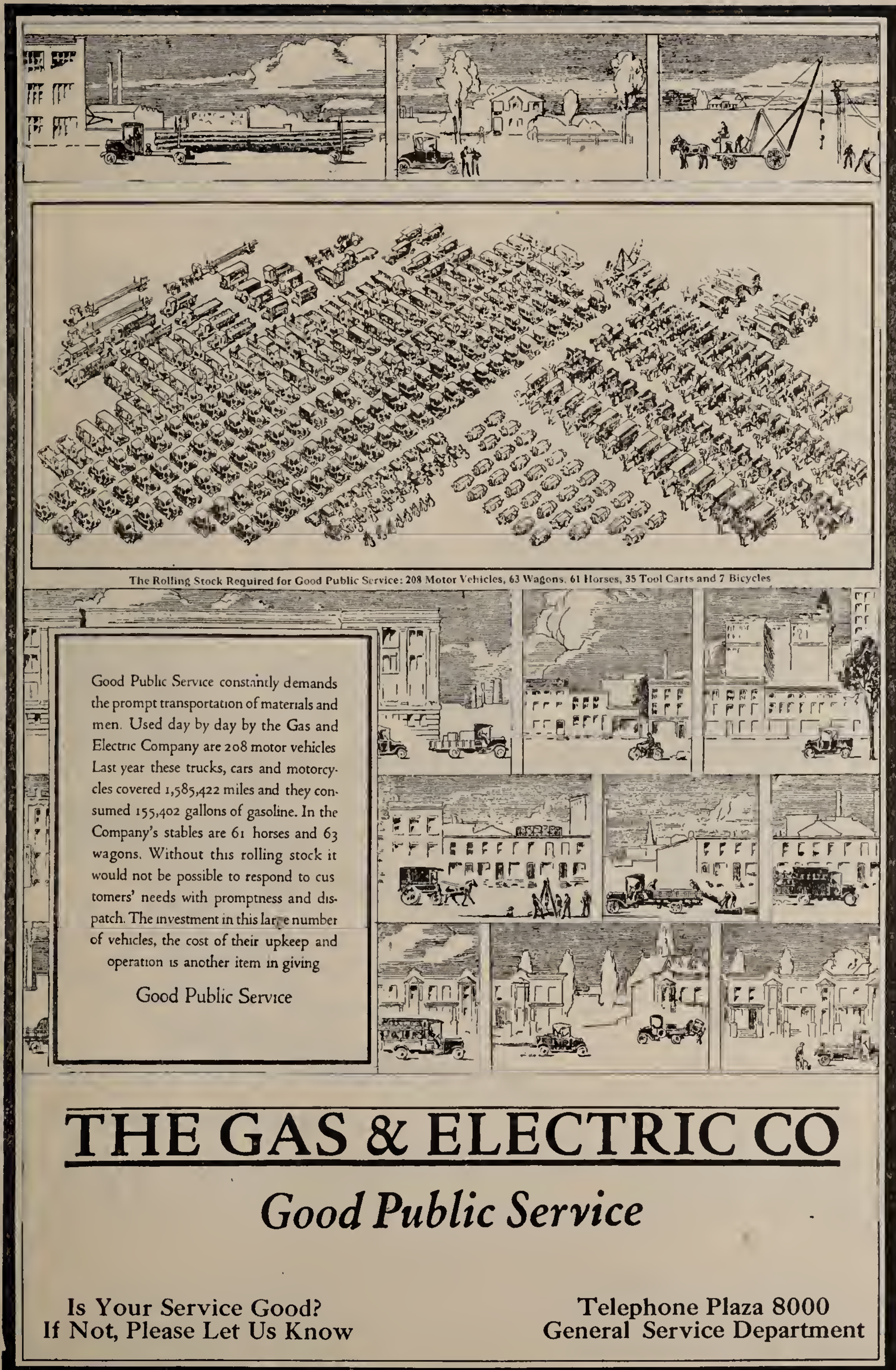
The ordinary gas range has about one hundred unit parts. Good Public Service demands that the right part be in the right place in the right way.

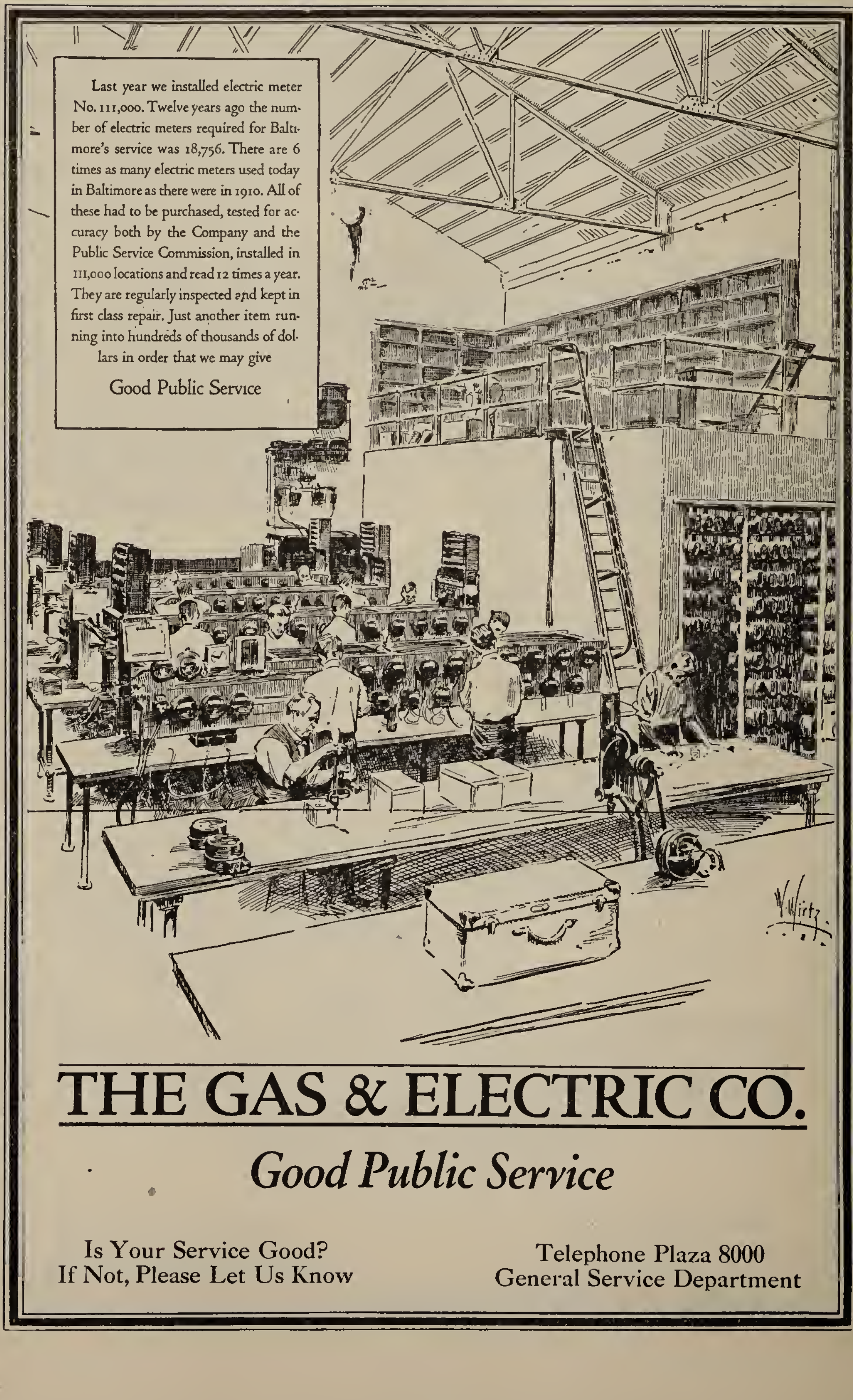
THE GAS & ELECTRIC CO

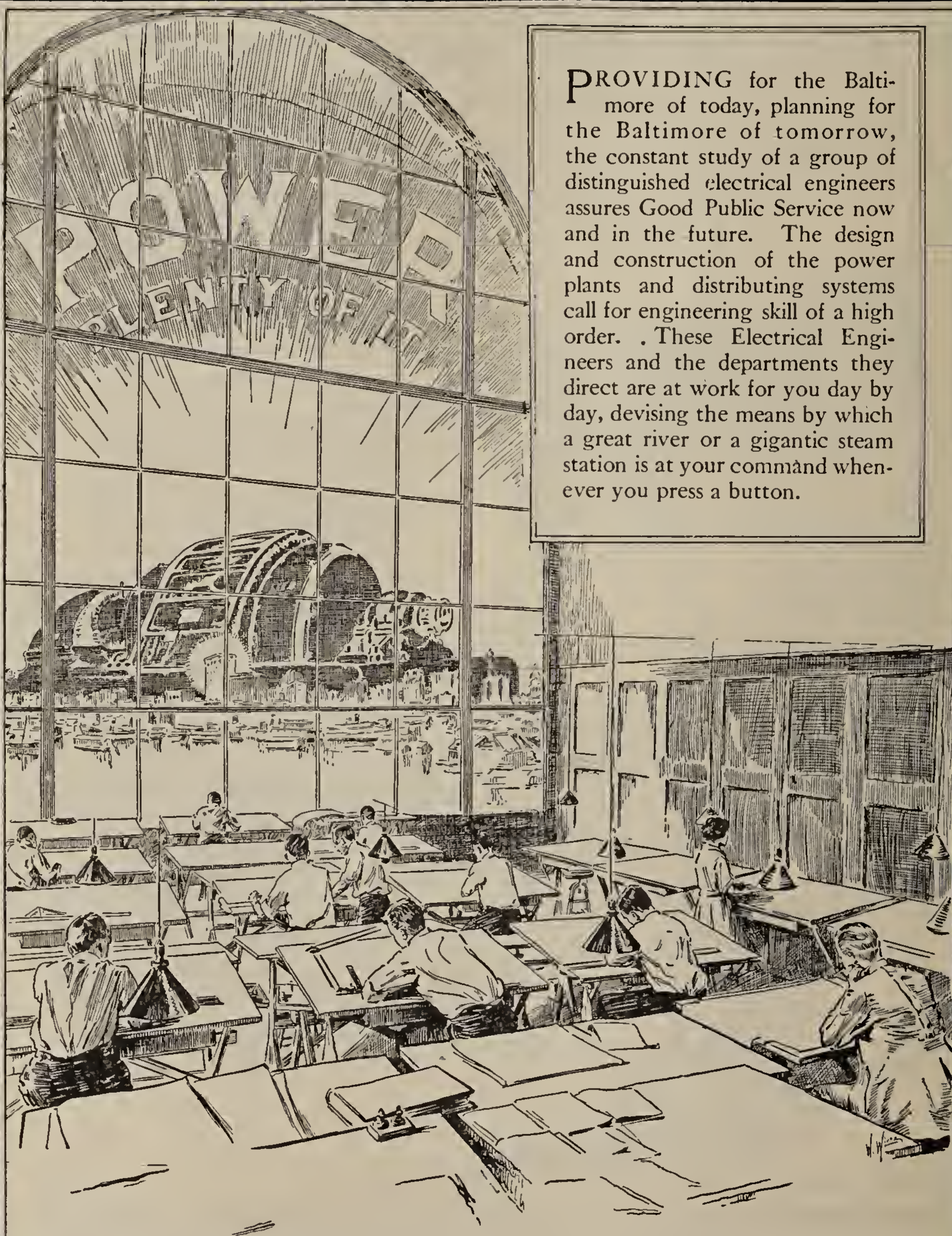
Good Public Service

Is Your Service Good?
If Not, Please Let Us Know

Telephone Plaza 8000
General Service Department


The Rolling Stock Required for Good Public Service: 208 Motor Vehicles, 63 Wagons, 61 Horses, 35 Tool Carts and 7 Bicycles
Good Public Service constantly demands the prompt transportation of materials and men. Used day by day by the Gas and Electric Company are 208 motor vehicles Last year these trucks, cars and motorcycles covered 1,585,422 miles and they consumed 155,402 gallons of gasoline. In the Company's stables are 61 horses and 63 wagons. Without this rolling stock it would not be possible to respond to customers' needs with promptness and dispatch. The investment in this large number of vehicles, the cost of their upkeep and operation is another item in giving
Good Public Service
THE GAS & ELECTRIC CO
Good Public Service
Is Your Service Good?
If Not, Please Let Us Know
Telephone Plaza 8000
General Service Department


Last year we installed electric meter No. 111,000. Twelve years ago the number of electric meters required for Baltimore's service was 18,756. There are 6 times as many electric meters used today in Baltimore as there were in 1910. All of these had to be purchased, tested for accuracy both by the Company and the Public Service Commission, installed in 111,000 locations and read 12 times a year. They are regularly inspected and kept in first class repair. Just another item running into hundreds of thousands of dollars in order that we may give
Good Public Service
THE GAS & ELECTRIC CO.
Good Public Service
Is Your Service Good?
If Not, Please Let Us Know
Telephone Plaza 8000
General Service Department



PROVIDING for the Baltimore of today, planning for the Baltimore of tomorrow, the constant study of a group of distinguished electrical engineers assures Good Public Service now and in the future. The design and construction of the power plants and distributing systems call for engineering skill of a high order. These Electrical Engineers and the departments they direct are at work for you day by day, devising the means by which a great river or a gigantic steam station is at your command whenever you press a button.

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The Chairman: I am going to take the Chair's privilege of calling attention to one paragraph in Mr. Hawks' paper, not that there is any difference of opinion from my point of view with what he has expressed, but unless the gas industry has gone through a revolution in the four years with which I have been acquainted with it there must be people who do not agree with it. If there are, let us get their point of view out here for straight, concrete discussion. The particular paragraph that I have in mind is on the third page of his report, which says: "The phrase, 'Is your service good? If not, please let us know,' has been printed over 31,000,000 times in the Baltimore newspapers."

I am assuming that Mr. Hawks would not have that printed 31,000,000 times if he did not believe that it is a good thing. But I know that there are a lot of people in the gas industry who do not believe that it is a good thing to invite your customers to tell you what is wrong with your service. If we have any such among us let us get their point of view on this particular question.

W. P. Strandborg (Portland, Ore.): With reference to that phrase, "Is your service good? If not, please let us know," I am not going to start any argument with it at all, but I like particularly the way it is worded. I say that for this reason: A large number of companies that advertise rather boastfully say, "We invite complaints. If you have any complaints please send them in." I maintain that that statement suggests a negative reaction in every customer's mind. If you say, "If you have any complaints, send them in," a fellow will sit down and say, "Well, my service isn't as good as it might be, I guess I will take a crack at it."

This does not suggest that the service is wrong, but if there should be any difficulty at any time it puts it in a way that gives an affirmative reaction. We have practiced for some time sending out small circulars with our letters that come out in the form of complaints. We use the word "Suggestions." If your service is bad there may be some particular local or temporary condition which makes your service bad. But instead of inviting people to complain about it, if you give them to understand that you are always inviting suggestions for improving your service, it gives an entirely different slant in your customer's mind.

The Chairman: If you will bear with me I want to tell you about this phrase. I think it was an electric company that used it a good many years ago on a billboard in one of the larger western cities. I have always been hoping the time would come when I could use it in my own company, but I never got everybody concerned worked up quite to the right point. The phrase was: "Tell your electrical troubles to us instead of the neighbors. We can help you. They can't."

I offer it to you for any use that anybody else may have for it. Perhaps some one will have a little more nerve than I have to make use of it.

Publicity and advertising men are sometimes accused of shooting in the air and of being theoretical in their ideas when they try to point out to the old and experienced and case-hardened gas company executives the effectiveness of doing some of the things that we advocate

doing. Reference has been made today to some of the experiences in contact with newspaper associations and with one in particular, the Inland Daily Press Association.

Mr. Carmichael, the Director of the Iowa Committee on Public Utility Information, is here fresh from the session with the Inland Daily Press Association in Chicago. I do not know what his experiences have been, but I am going to ask him to tell us concretely just what he has been through there and its relation to our industry and our work as he sees it.

Joe Carmichael (Des Moines, Iowa): I had the very great pleasure yesterday of addressing the Inland Daily Press Association.

To begin at the beginning, some of the directors in the middle western states had run up against the association in a very unfavorable way during the last six months. The Inland started a campaign about a year ago against what they called "the free publicity graft." The association comprises newspapers in Michigan, Wisconsin, Minnesota, the Dakotas, Nebraska, Iowa, Illinois, Indiana, Ohio and Missouri, and they agreed among themselves that all free press dope, as they called it, that they got from any source, would be wrapped up in a package at the end of each week and sent to the secretary. The secretary was to return all such matter to the source from which it came, with a form letter asking the people who sent it to please take the papers off their mailing list—that the papers would not use it, did not want to receive it, and if they wanted it, it would have to come through the advertising department.

We got our heads together, discussed the matter, and felt that we should not be considered in that group. Quite a few of the directors got some of their bulletin matter back from the newspapers. So I went to Clinton, Iowa, the home of the secretary, and took it up with him. We had a session of about two hours. I explained what we were doing and was able to convince him that the committees on public utility information were doing his newspapers a distinct service in promoting advertising. I was so successful that he included in his monthly bulletin a commendatory reference to our work.

Mr. Strandborg wrote him a letter and enclosed his bulletin to the public utilities of the country, containing twenty-seven reasons why they should advertise. Mr. Tuffert ran Mr. Strandborg's letter and these twenty-seven reasons in his bulletin. And then he asked the president to ask me to talk to the association at its meeting in Chicago, which was held at the Morrison Hotel yesterday. I did.

As soon as I got this invitation I wrote to all the directors throughout the country and to some of the leading utility executives in my own state, telling them about it and asking them for their ideas. What I told the Inland Press yesterday was a review, a resumé of what the other directors told me.

I told them, and emphasized at the very start, that we were publicity bureaus, and not essentially advertising bureaus,—that we were just exactly what our name implied, committees on public utility information. I told them that we had found out at the start that if we were to do our companies the greatest possible good we should put this publicity matter on a sound economic basis. I told them that as newspaper men, we directors realized that ad-

vertising would have to be paid for and that news space could not be bought. I then rehearsed to them the experiences of the various directors and what they had done to promote advertising.

The Illinois committee members told me that they have increased their newspaper advertising about 2,000 per cent since the committee was organized less than five years ago. The Ohio committee informed me that when the committee was organized public utility advertising amounted to about $100,000. It is now about $500,000 and is constantly increasing. I told them that I knew personally of the good work the Michigan, Wisconsin, Indiana, Missouri and other committees were doing and that Secretary O. O. Buck of the Nebraska Press Association had stated publicly that since the Nebraska committee was organized the newspaper advertising of the utilities had increased 1,000%. I told them, also, of the work of the Louisiana committee and the Rocky Mountain and other committees. I told them what we had done, particularly in Iowa, that we did not depend on the companies' reports for our knowledge of what they were doing, but we subscribed for every newspaper in the state, daily and weekly, checked these up carefully each day and that our check-up of all newspapers, all advertising and news matter pertaining to the utilities, is copied and placed on my desk each day.

Our check-up at the end of the first six months showed that our companies had done twice as much advertising during the first six months of this year as they did all of last year, and that we expected the second six months to show twice as much as during the first six months. It was not bunk, it was the actual figures, and I showed them the advertising matter.

I tried to impress on these gentlemen the necessity of selling their advertising on its merits, not because they were a power in the community. I told them that I believed that there had been too much of that done; that they had not made the proper attempt to sell them the advertising on its merits.

I spoke briefly of the municipal ownership situation. I told them that our committee was not organized to combat municipal ownership, but that, as a committee on public utility information, we were called on constantly for data on municipal ownership and we were able to furnish it. I called their attention to the fact that municipal ownership of public utilities was not so important as a great many people seemed to think. The fact is that one company in Chicago, the Commonwealth Edison, I believe, generates more electrical energy than all the municipal plants in the United States.

What I wanted to drive at particularly to these editors in reference to this matter was the fact that municipal public utilities do not advertise. The newspapers are called on to do most of the work to promote and organize municipal utilities, and when they have organized them they have destroyed a potential customer. It is absolutely true in Iowa that no municipal electric lighting plant advertises and I do not know of any in the country that does, although there may be.

I called attention also to the field offered to them in the securities field, a field that had scarcely been touched. I said it was up to them to go out and sell this public utility advertising on its merits,—that we, as committees on public utility information, had paved the way for them.

The Chairman: I think we are under obligation to Mr. Carmichael for his recital. My own financial sense may not be very keen, but it seems to me that getting the opportunity for a man like Mr. Carmichael to appear before an organization such as the Inland Daily Press Association and put before them the situation as it exists, is worth a very considerable part of all that gas companies or other public utilities have paid for this sort of work in the territory that the Association covers.

PUBLIC RELATIONS WORK ON THE PACIFIC COAST

R. E. Fisher, Vice-President, Pacific Gas & Electric Co., San Francisco, Cal.

In the brief paper prepared for your consideration on Public Relations Work on the Pacific Coast, a comprehensive analysis has not been attempted. Due to recent changes in the organization which I represent, additional duties have devolved upon me which were not anticipated at the time this assignment was accepted, and which have prevented me from giving either the time or study to this paper which the importance of the subject warrants.

Public Relations, to my mind, is the foundation upon which the ultimate success or failure of all industry rests. Public Relations may be good or bad, and may vary in degree between either of these extremes. If good, the success of that industry is assured, and the degree of excellence attained will be the measure of its success. If bad, the reverse is true, and if improvement be not made, that industry is doomed to early failure, or at best to a precarious and unsatisfactory existence.

From what I have said, the logical deduction is that good Public Relations is a most vital asset in industry. This is particularly so of the gas industry, involving as it does many complex and difficult problems in the manufacture, transmission and distribution of its commodity, and subjected as it is to adverse and unfair attack by the uninformed public and the communistic press.

It behooves us, therefore, to effect a policy that will place our Public Relations upon a plane which will procure to the industry a maximum of potential results. In arriving at this policy we must ever keep before us the fact that maximum results are obtained only when society, or the consuming public, is rendered the fullest measure of service within our power to perform.

Service, then, becomes the dominant factor in Public Relations, and on its proper development the very foundation of our success depends. Build your service plan on broad constructive lines, and in its administration remember always that the consuming public, in the final analysis, is the judge of our business destiny.

Having established a definite policy along the lines herein suggested, the next step is to bring that policy to the attention of the consuming public, and it is this phase which I will endeavor to discuss insofar as it concerns some of our efforts on the Pacific Coast.

The necessary publicity to accomplish this desired purpose has been secured through various mediums, differing somewhat in the several geographical locations, but in general following the same fundamental plan. Time will not permit a presentation of the methods employed by all Pacific Coast companies, so I am taking the liberty of outlining the policy now in effect by the Pacific Gas and Electric Company, and which

can, I believe, be considered typical of the efforts these companies are expending in arriving at a common objective—namely, a high standard of Public Relations.

This particular policy or plan as predicated on self-interest appears to the several component factors involved and as listed below.

First—Appeal to the Employee
Second—Appeal to the Stockholder
Third—Appeal to Consumer
Fourth—Appeal to Dealer
Fifth—Appeal to Public

1. The employees of any industry, when properly educated and instructed, constitute a very tangible and important asset. The employee's attitude when contacting with the consumer or public, reflects, or should reflect, company policies, and provides the most direct expression of those policies. The importance, therefore, of proper employee attitude is paramount. It is obvious that if the employee is to perform his full function in this respect, he must be kept fully conversant with the company's basic aims and objects. It is the company's responsibility to see that this is done. Our practice in performing this responsibility has been by means of short addresses by a competent company employee, and which are presented at group or sectional meetings of our Employees' Association, an organization 6,000 strong. Some ideas of the character of the addresses may be had from the following list of subjects:

1. Definition of Service.
2. Fundamental Company Policies.
3. Value of Courtesy.
4. Proper Use of Telephone.
5. Relation of Service to Good Will.
6. Advertising Value of Employee Contact with Consumer.
7. Sales Possibilities of Employee.
8. Ownership of Company Securities.

At the conclusion of these short addresses, the meeting is conducted as an open forum for the full discussion of the subject presented. The employee is impressed with his importance in the company organization, and is encouraged to give complete expression to his individual view. As indicative of this we suggest to each employee the following pledge:

"I am at all times the individual personal representative of and for this company, regardless of my department or duties, and it is for me to see that the policy of this company—that of rendering service in its broadest sense—is carried on."

Results obtained from appealing to employee activity have been most gratifying.

2. Appeal to Stockholders. District meetings for stockholders are held from time to time in different localities throughout our system, with very beneficial results. To date, 24 such meetings have been held. A general report on the company's activities, its accomplishments and its problems, is given at these meetings by officers of the company, and the stockholders are invited to offer any constructive suggestions or criticisms concerning the conduct of the company's affairs. Stockholders are automatically placed on the mailing list for the company magazine, a copy being sent them monthly.

Consumer ownership of public utilities has been accepted by the industry throughout the United States as a sound fundamental policy. I trust I may be pardoned when I say with some pride that the Pacific Gas and Electric Company was the pioneer in this field. The wisdom of this plan is evidenced from the fact that practically every utility of note throughout the United States today

has endorsed and is now following this policy. It has resulted in placing a very substantial quota of public utility securities in the hands of the consuming public, and the time is rapidly approaching when, through this plan, public ownership of public utilities privately operated will be an accomplished fact.

We have found the stockholder in general to be alive to his responsibilities to the utility whose securities he holds, and his cooperation has been both hearty and beneficial.

3. Appeal to Consumer. All large consumers are approached by means of a letter expressing the company's appreciation of their business, defining our service in its largest sense, and proffering to them the services of our engineering force to assist in any way with the more efficient use of our commodity.

Return postal cards are being mailed to each and every consumer inquiring if service is satisfactory, and inviting complaints as well as suggestions for service improvement. This is a regular routine in our territorial divisions, and is being carried on as expeditiously as possible, and in such a manner as to avoid any congestion that may interfere with prompt attention to all replies received.

In addition to this approach to the consumer, we are carrying out a systematic canvass of all large consumers. In this canvass full explanation is made of the company's facilities for rendering service, and the organization it maintains for providing engineering assistance in the problems involved and use of our commodity. We feel that much good is resulting from this activity in the way of improved relation.

4. The appeal to dealers is carried on generally through organized societies in the industry, such as Retail Furniture Dealers Association, Retail Hardware Dealers Association, Master Plumbers Association, Sanitary Development League and the Gas Appliance Dealers. In California this work has been simplified and greatly expanded by the organization some two years ago of the Gas Appliance Society, which may be referred to as a clearing house for all the organizations as listed. One of the cardinal objects of this society is, "To establish a spirit of fraternity between the members by social intercourse and exchange of information; extension of more cordial and friendly relations between manufacturers, jobbers, distributors, retailers, gas companies and consumers; and to facilitate the education of employees of its members to enable them to better perform their duties." This society is actually living up to the letter and spirit of the above principle, and through sincere and intelligent cooperation has contributed measurably to the general improvement of Public Relations in the territory served, embracing, as it does, a total of 750,000 gas consumers. Our company is an active member of the Gas Appliance Society, and feels that its participation in, and support of, the society's activities is fully warranted by the favorable results so far obtained.

As a concrete example of what cooperative effort will do, it may be of interest to know that during a recent Appliance Week Campaign, fostered by the Gas Appliance Society, a total of 31,147 column inches of newspaper advertising was used in publicity work, this being of actual record in the files of the society. Prior to this particular campaign, special writers were engaged to prepare stories or semi-news articles suitable for newspaper work. Twenty

of these special articles were written, and 500 copies of each were multigraphed, making a total of 10,000 copies. These were mailed to every one of the 502 newspapers in California, together with a personal letter explaining in detail what was to be accomplished during the week. The united front presented by this concentration of advertising was most effective, and the publicity impressed the general public that the gas industry had a real and sincere desire to make its service as nearly perfect as possible.

This company also, through its representatives, maintains contact with various other organizations such as luncheon clubs, farm bureaus, etc.; illustrated lectures descriptive of company properties, and motion pictures in conjunction therewith have been given before a large number of public meetings. These lectures and motion picture features are universally well received, and do much towards acquainting our consumers and the public in general with the company and its facilities to serve.

I shall not endeavor to go into the details of our affiliation with the Pacific Coast Gas Association. This association, as you know, is designed to accomplish for the Pacific Coast what the American Gas Association does nationally. Personally, I believe that much good results from the activity of the association, and our company takes an active part in its work and is well represented at all the annual meetings.

We do not overlook the value of the personal contact established with representative men of the industry along the coast. By interchange of ideas at these conventions, it enables us to better understand the various problems of the utility, and often provides an inspiration which leads to the solution of some of our own.

5. Appeal to the Public. An extensive advertising campaign is being carried on in the following publications:

62	daily newspapers
140	weekly newspapers
6	monthly publications
3	farm publications
8	foreign language publications

One hundred twenty-six thousand column inches of space will be used during the current year, of which 77,000 will carry institutional or goodwill messages. In addition to this advertising, approximately 75 newspaper articles are written by company representatives each month in which we place before the people information as to the company's activities, and we have had unusual success in securing cooperation from the newspapers in publishing these articles as news items.

The company maintains demonstrations at all representative fairs and expositions, in addition to minor ones carried on continually throughout our various divisions. While these may be primarily considered as affecting sales, they are so designed that a message of service is conveyed to all those attending. A very large number of our consumers and the public is reached through the medium of these demonstrations, and we feel that they justify themselves many times over.

Educational trips to company properties have become a regular feature of its activities. These are attended by editors of newspapers and leaders in all lines of business, who thus have been afforded an opportunity for first-hand observation of the company's properties and organization. A great deal of favorable publicity has resulted from these trips.

In this brief summary of some of the Public Relations work on the Pacific Coast, I have outlined a plan which from personal observation has been instrumental in establishing and maintaining the gas industry in a favorable attitude towards its consumers and the public, generally. No claim for its perfection is made; we are constantly striving for improvement, and the plan is modified and expanded from time to time as experience dictates. I am confident, however, that it is fundamentally sound, and, with the improvement in its application which time and practice alone will insure, is destined to play an increasingly important part in the consummation of our highest ambition—the superlative in good Public Relations.

The Chairman: I would like to revert once more to the point that has been expressed at other times, and that is, the lack of adequate sense in the gas industry, not only among higher executives but less high executives, as to the importance and usefulness of some of the machinery and activities with which this section has been connected.

Take, for example, just one point. Suppose, for instance, this coming year, which is a presidential year, some political party follows the lead of the American Federation of Labor and declares itself for municipal or public ownership of all manner of public utilities analogous to declaration by parties on other subjects. This matter of public ownership then becomes not a local question in Atlantic City or Philadelphia or even in Pennsylvania or New Jersey, or Oregon or any other one state; it becomes a national question.

These bodies called state committees on public utility information, each operating within its own territory, if you please, but all together forming a composite piece of machinery for dealing with any national question of absolutely national scope in which this or any other branch of the utility industry may be interested, are able to deal with it and to deal with it effectively.

J. S. S. Richardson (Philadelphia, Pa.): After listening to the illuminating report of Mr. Strandborg on the Public Utilities Advertising Association, it perhaps might be well at this time for him or someone to elucidate the fact that there is no conflict between the work of the committees and the work of that association. In the minds of some there may be an idea that there is.

W. P. Strandborg (Portland, Ore.): There can be no conflict whatever between the work of the Public Utilities Advertising Association and the state committees. The Public Utilities Advertising Association is an official department of the Associated Advertising Clubs of the World, that is, it is one of the twenty-three departments of the National Advertising Commission, as such. Its work is devoted to the furthering of the cause of "Truth in Advertising." It is also devoted to furthering the interests of what we call "paid publicity." It endeavors to get the public utilities to advertise regularly and consistently, that whenever they have a story which they believe is worth telling it should be paid for just exactly as you go and pay for a suit of clothes. The Public Utilities Advertising Association maintains that you have no more right to go into a newspaper office and ask for the working capital of that publication—its news columns—than you have to go into a grocery store and ask the grocer to give you a pound of butter or a dozen eggs.

We are talking business in terms of paid publicity only. The state commit-

tees are devoting their efforts to provide the public with the essential facts and information about the public utility industry and nothing else. It is giving that information to the public through the greatest medium which the public has available, the daily press and the weekly press.

The only interest that lies in common between the two associations is that the state directors may increase the value of their effort by showing the public utility companies the advantage of using more advertising because advertising pays, and because, as Mr. Carmichael has ascertained, the public utilities who do advertise get more material in the papers in the news columns. The work is co-operative and without conflict.

ADJOURNMENT.

THIRD SESSION

Thursday Afternoon, October 18, 1923.

SYMPOSIUM

State Committee Work

The Chairman: Originally Chairman Gettle of the Wisconsin Commission was scheduled for an address to this section, but as you recall, he went on the General Session program yesterday morning. That leaves us specifically this symposium on state committee work in its various aspects. The questions are: the bearing of this work upon public relations in the industry; the efficacy of this work in helping individual companies, especially smaller ones; the usefulness of it in relation to political and newspaper radicalism; its relation to legislative, commission and political situations of all kinds; its usefulness in dealing with troubles, irritating circumstances, irritating discussions that arise out of inadequate public relations work by small companies; its relation to advertising and the importance of advertising; and the need of having it sold more effectively than it has been sold yet to subordinate officials as well as to higher executives.

I am going to ask Mr. Groce to start off the discussion on state committee work with respect to its significance as a nation-wide movement.

J. B. Groce (Boston, Mass.): There are twenty-five committees now serving thirty-four states. One phase is the fact that there are about three hundred leading public utility officials meeting on the common ground of establishing better public relations throughout the country and discussing face to face, as they get together, the problems common to all of them. There are four branches of the public utility industry where the leading officials are getting together more or less regularly, in some of the states regularly every week, and talking over common problems. That, of course, is in itself a significant fact. To my knowledge that was not done previous to the formation of these committees. It has been done, perhaps, in a smaller way but not by such a large group of men.

A few years ago the public utilities had little to tell the public. Today there is a concerted effort all over the country to educate the public. That seems significant. It does not necessarily signify a change in methods of doing business, but it does signify, it seems to me, a decided change in the attitude of the public utility officials toward the public, and I think it is being appreciated both by the public officials and the general public. I think the public utility commissioners, through this movement, are realizing more and more that the public utilities mean business on this proposition,—that they are really honest

in their effort to get this information across, and I think that is of great advantage to the utilities.

It is a nation-wide movement to make the public appreciate the real value of these public utilities which have not been appreciated in recent years. As the public utility business has developed, utility service has been taken for granted. This is a movement to make the public really appreciate, through publicity, that without this service the country is not going to progress. In other words, it is absolutely necessary to have successful public utilities for the successful development of the country.

We are publishing now in the various state bureaus in the neighborhood of 75,000 bulletins a week. These go out to all the newspapers of the country, to the leading banking houses, to the public libraries and college libraries, to the Kiwanis Clubs, the Rotary Clubs, Chambers of Commerce and Boards of Trade. They are reaching a class of people who are thinking people and the information is going direct to them aside from the publicity in the newspapers.

It does not seem to me that we can have a centralized governing or consulting board in regard to the work of these committees. We all have local problems and have got to work them out as best we can in our special communities.

The Chairman: Probably there is no one state where the public relations aspect in all of its ramifications and in all of its significance is more acute at the present time than in the state of New York. I am going to ask Mr. Crone, who is the Director of the New York committee, to speak to us.

F. W. Crone (New York, N. Y.): The state committee on public utility information is an agency for interpreting the utilities to the public. It is also, by virtue of that fact, I think, an agency for interpreting the public to the utilities, and in the long run I am rather of the opinion that that is the more important part of its work. It has particular and peculiar qualifications for that work.

The committee is made up of leading executives from all parts of the state. They meet together regularly. They get down to cases and chew over the situation of their own companies and the situation of the industry generally in the state.

In addition to that we directors are supposed to have particular and peculiar qualifications for sensing public opinion, for knowing what it is at a given time and for following its changes and fluctuations. We clip all the principal newspapers of the state and talk with newspaper men and utility men from all parts of the state, with politicians we know and others, so that we must have a good, accurate knowledge of what is going on in the general utility situation at any time so far as the relation of the utilities as companies and as an industry to the public are concerned.

It seems to me that this peculiar and particular advantage that the committee has in these respects is a thing that inevitably is going to become more and more important in its work. A lawyer is just as useful to his client for what he tells that client he may not do, or it would be inadvisable to do, as he is for what he tells his client it is perfectly proper and possible to do. I think the committees in relation to the utility industry have exactly that bearing. They know when a given course of action is going to be the proper course of action so far as the public is concerned. They

can recommend such a course of action. It becomes, then, the subject for discussion in the committee and with other people who may be called in. Whether the action is decided on depends on the utility men, but at least they have had the advantage of having that course of action presented to them and discussed with a particular knowledge of the public reaction that is going to happen if that action is followed and what is going to happen if that action is not followed. I do not think that, before the committees were established, there was any group within the industry where that situation obtained.

For instance, various company operators might get together and talk over a legislative situation. They might agree that a certain course of action was desirable so far as they were concerned, but it has been my experience as a newspaper man—and it appears to have been the case in most instances from what I have heard since I got into this game—that they do not go at it from the angle of what is going to happen when the public gets busy. Now, our committees are able to show them what is likely to happen. I do not mean to say that they tell the companies or tell the industry, "This must be the policy." Naturally they could not tell any company that and get away with it. But what they can do, what they are doing, and I believe what they have got to do in far greater measure, is to show just what will happen in a given situation if a certain course is adopted, what will happen if a certain course is not adopted and why the suggested course should be followed, and that, I take it, is a fairly important part in the matter of public relations.

The Chairman: Probably no state committee in the last year or two has had more intimate contact with political situations of one kind or another that would affect commissions and legislatures than the Indiana committee. I am going to ask Mr. Mellett, the director of the Indiana committee's work, to give us the point of view on that phase of this general subject from practical experience there.

John C. Mellett (Indianapolis, Ind.): The Indiana committee takes no part in politics as the word is popularly understood. The committee has nothing whatever to do with any party or inter-party politics. It takes no part in any affairs affecting anybody's candidacy for any office. We keep out of personal and party politics altogether.

Our work in politics has been simply the protection of state regulation, which is vital to the industry in Indiana as elsewhere, and we work along that line regardless of party and regardless of individuals.

P. H. Gadsden (Philadelphia, Pa.): This is an economic movement. We have spread broadcast the statement that we do not deal in propaganda. What we are trying to do is to teach the economics underlying the operation of these properties and let the properties speak for themselves. Let us stick to that. We have all made a great many mistakes, but do not let this organization cover too much territory. Your job is to preach in season and out of season, by day and by night, the economics of public utilities and nothing else, as I see it. Do not try to invade the province of the other fellow. We are all organized to handle the various problems affecting this industry. One of the great handicaps we are all laboring under now is unquestionably the fact that public utilities in the defense of their properties were

forced to take a more or less active part in political matters and political campaigns.

Since within the last ten years, certainly since the organization of commissions, that situation has been very much relieved. But we are still carrying the burden of an imputation that we are attempting to influence and control and direct the political affairs of the state. We have nothing in the world to do with it.

I can not be too urgent, in talking to you gentlemen, that that is one thing that will break you up, in my judgment. You will immediately lose the confidence of the press and you ought to lose it, because your platform, to which you have up to this time secured their confidence, is that you are not going to try and put anything over on them.

You started out with a new gospel that you were going to be open and aboveboard and were going to tell facts. Now it is inconsistent, in my judgment, to attempt to influence the political course of action of a state. I do not mean to say that when bills are introduced in legislatures that the representative of the committee might not go down to a committee to point out the economic fallacies in that bill or how it is going to react against the industry, because that is business and not politics. I do not think that this organization has anything to do with politics, and, I sincerely hope that we will adopt, as one of our cardinal principles, to stay out of anything smacking of political activity.

The Chairman: Mr. Crone, what is the attitude of your committee and what are your difficulties?

F. W. Crone (New York, N. Y.): The attitude of our committee is this: We started in, as every other committee has done, with the statement that we were not propagandists and we had nothing to do with politics.

It is perfectly true that the committees on public utility information ought not to do anything that savors of playing partisan politics; nevertheless, they stand before the press of the state, if not before the public of the state, as the mouthpiece of the industry, the organization which is supposed to furnish information about the industry and about the bearing of the operations of the industry on the public's interests.

When there is a bill before the legislature that is as drastic as the proposals that were introduced at the last session of the New York legislature, it seems to me that it is the function and the duty of the committee, not as a matter of politics but as a matter of information, to tell exactly what such a bill, if enacted into law, would do to the utility industry and would do to the public.

It seems to me that the common sense method of going at it would be to go to the voters. They are going to settle it in the end. What they tell the politicians is the thing that is going to be acted on. It seems to me that the way to get at it is to tell them exactly what will happen if such proposals as are made are enacted into law. Tell them in every possible way, through communications to the press, through speakers, through pamphlets and every other way that is open to an organization. Let them get the thing soaked into them and then let them decide and when they decide the utilities naturally have got to take what they decide.

J. L. Murphy (Georgia): Our committee is an association of the utilities. Every utility in the state except one, a

very small one, is a member of it. The idea has been fostered of bringing the officers and the executives together to talk over their difficulties, their troubles, and to exchange views. It has done a great deal of good. We issue bulletins, but they are really more of a newspaper than a bulletin. They deal with live subjects. At the present moment we have two issues of the bulletin going out, dealing with the subject of taxation, there being a special session of the legislature called for the first week in November to revise the taxing system of the state and the disposition is to make the utilities pay an unfair part of it.

The bulletin which we mail, has a circulation of from 20,000 to 22,000. Each envelope is addressed separately and mailed to a live citizen. That mailing list includes every preacher, doctor, dentist, judge, sheriff, constable, county clerk—every man in the state who is elected by the people. That costs some money. The issue of that bulletin costs around $700, but we have found that it has more influence than any other single thing we have done except a speaker addressing gatherings of farmers and voters.

We rely on the newspapers, but when we send an article to the newspapers we write and ask them to print it and send us their bill for it. When we undertook our public ownership fight there were about one hundred and fifty papers in the state in which were appearing communications from some public ownership advocate, published free. We had a series of twelve advertisements, as we call them—they were written articles, published as news articles—one appearing each week, of about three-fourths of a column each. When the third advertisement appeared, we sent a man to each newspaper office and called attention to the fact that we were paying for these articles which told the truth about the public ownership proposition and that it was not fair that the other side of the story should be printed free of charge. The result is that today there are only five newspapers in the state of Georgia out of two hundred and fifty where there is any such anti-public utility propaganda printed.

Within the last twelve months we have not spent over $4,000 for all the advertising we have done. The advertising in 1920 cost us a little less than $13,000 for the year. We think that a change would have been accomplished by the same procedure that you gentlemen use here, but it would have taken five, six or seven years. In the meantime the bills would probably have become law.

The Chairman: Gentlemen, the President of the American Gas Association has just come in. I know that you would like to hear a few words from him.

The President: I am very much interested in this work that you are doing. I do not know that I need to prove it to you, but it might interest you to know that after Illinois got such a wonderful start and we had to use smoked glasses to look at their record, we thought it might work out in Wisconsin.

I certainly have been gratified to see the way it has spread all over the country. It is a work that certainly is doing about as much for the rejuvenation of our gas association and the industry as anything that we could do. It is something that has been needed, and yet we had to wait a good many years for some one to show us just how to do it.

The Chairman: Mr. Brown is probably too modest to say for himself what

I shall undertake to say for him, although inadequately. The evidence of his interest in this sort of thing does not rest on what he has told you about his connection with the Wisconsin committee. The record of the American Gas Association during the last year under his administration, of which I can speak with some personal knowledge, having been at the head of this section, is even better evidence and a very much larger sum total of evidence of his interest and his appreciation and the encouragement which he has given and will continue to give to this sort of thing.

We are also honored this afternoon with the presence of the President-elect of the American Gas Association.

J. B. Klumpp (Philadelphia, Pa.): I am just going to give you words of greeting and I trust that in the coming year your efforts will be as successful as they have been in the last two. I believe that Mr. Bennett of Philadelphia is to be the leader of this section next year. He and I are good friends and he promises me everything from this section and I am going to look for it.

The Chairman: We will undertake to take up where we left off at the conclusion of Mr. Murphy's talk. Mr. Murphy mentioned the matter of employment of advertising in their work in the state of Georgia. Perhaps not directly pertinent to that phase of the discussion, but a part of what we had to consider this afternoon, was how this matter of advertising ties in with state committee work and is correlated with it. I do not believe there is anybody present who has had more experience of a concrete nature along that line than Mr. Carmichael of Iowa.

Joe Carmichael (Des Moines, Ia.): The Iowa committee is thoroughly sold on the merits of and the absolute necessity for advertising. When the committee was organized and I was employed as director they instructed me to put the publicity on a sound economic and business basis. I had had some experience in newspaper work as city editor and as advertising manager in the advertising office and I thought I knew something about the question from both angles. We were determined that we were going to try to impress on all member companies and all companies in the state, whether they were members of our committee or supporting our committee or not, the absolute necessity for newspaper advertising,—that there were certain things that they could say through the advertising columns and certain things that they could say through the news columns. It was up to us to get the news story over to the newspapers, but the companies must advertise themselves. It creates better relations with the newspapers, naturally. I know it.

Mr. Strandborg spoke yesterday of a conversation we had had in reference to keeping track of the advertising done by the newspapers. We have a list of the newspapers of the state, arranged alphabetically by cities; another list arranged by companies, companies who serve a large number of towns. We check up all the newspapers. We subscribe for every newspaper in the state. The girls in the office go over these carefully every day and cut out all news and advertising matter. It is entered up on this sheet.

I know that the News at Arlington, Iowa, has used so many news stories from our bulletin or from the service that we send out. I know how many advertisements the News at Arlington has had during the year and how many

inches of advertising. And we find it true invariably all the way through the list that the newspapers which are using the news matter that we send out are newspapers that are getting some advertising. And the newspapers which are not using news about the utility companies which we represent are the ones which are not getting advertising.

Now it is a question of practical business. I know the attitude of my own newspaper when I was city editor. The advertising manager would pass the word along up the line, "Well, so and so isn't very friendly. They are not spending any money with us. Why give them a lot of news space?" You will find that is true on almost every newspaper. An advertising manager has something to say about what goes in the news columns. If it is a real live news story, of course, they will use it, but there is a whole lot of stuff that is on the verge of news that they can use if they want to and they will use if they are friendly.

Our companies in the state of Iowa have quadrupled their advertising in eighteen months, and I look for it to increase considerably more when our check-up is made for the end of this year.

I went into the office of an executive of an important company in the state the other day. He was a rather gruff and abrupt man and said, "Look here, Carmichael, I thought that when I subscribed to the support of this bureau it was only going to cost me one-tenth of one per cent of my gross for the year. Then you got me started on advertising and now it is costing me ten times as much as I expected." I told him that I knew I voiced the sentiments of the committee when I told him that I hoped it would cost him twice as much next year. He agreed with me that it would and that it was the best investment he had ever made.

We do not try to sell our companies on advertising on the basis that it is going to buy the newspaper. We try to sell them on the basis that they get value received for every bit of good advertising they do; not the advertising which just gives the name of the company and a list of the officers, but the advertising which tries to tell and sell something. I think we have advertising on a pretty good basis in Iowa and I know it has helped us a whole lot in the real work that we wanted to do.

The Chairman: All of these considerations impinge upon the questions that Mr. Abell asked us to discuss specifically this afternoon, as to what to do with the executives, as well as other officials, and even employees of public utility organizations, in the way of getting them coördinated with this work, and how far on this sort of thing the directors of it should try to influence executives, and how far executives should influence the work of these bureaus.

H. M. Lytle (Chicago, Ill.): When we started in this work in Illinois we had about as difficult a situation as could be imagined. I did not think that we would make a dent short of three years and I frankly told the committee that. I think the difficulty in some of these states—and I do not want this to be regarded as personal at all—lies in the fact that some of the utility executives are still twenty years behind the times and some of the directors think that they have to kowtow every time a member of their committee gives them the word, right or wrong. I think the thing is ironing itself out slowly, but if the director is not strong enough to stand up

against his committee then the whole job is useless.

The utility business four or five years ago was a different business from what it is now. There are a great many things that the newspaper men, particularly those who have gotten into this business, have found out about it. That is none of my business what they did find out. And what I found out, why, that is my business. But I am not playing the game of four or five years ago.

I have been a little surprised in all of this discussion to find that the three days have been confined strictly to the newspaper effort. I regard that as fundamental of the whole thing, but there are many other branches of the work. Our school work, our information work, the inquiries that come through my office, literally mount up into thousands a year. We have very close affiliations with the University of Illinois. The fact of the matter is, the only bill that we supported in the last session in the legislature was for an increased appropriation for the University of Illinois and we sent a utility delegation down to support it.

Advertising is a very important thing, but I regard it as purely a company proposition. I am not an advertising agency. I think, summing up the whole thing, that the fault lies with the executives and that they need a very liberal education, and I am very hopeful that there will be a very radical change in several of the states. I do not believe that where there is an executive mental attitude as exists now in several states that there will be any progress made, and I believe that there will be definite harm done to the other state committees. I am very hopeful that some one can get at the executives and do a little educating because I do not believe that the majority of them know what this is about at all.

Alfred Fischer (Ann Arbor, Mich.): In the state of Michigan we have fifty-nine gas companies, the large majority of which are small companies operating in towns ranging from 4500 population up to about 50,000 or 75,000. In the electric light field we have about twice as many companies outside of the Michigan Electric Light Association than we have inside for the outstanding reason that most of them operate on so small a basis that they can barely afford the cost of annual membership. In our work, of course, we make no discrimination. About four-fifths of the constant stream of requests for company service of one kind or another comes from these small companies. I have been director in Michigan through one legislative session and there was scarcely a week went by but what some of the small companies asked for legislative information: "We have a report that such and such a bill is about to be introduced providing for this or that. Can you tell us about it?" And just as a concrete example of the value of keeping in intimate touch with the smaller companies, I can cite one interesting illustration.

A special delivery letter came to my desk in the middle of the last session to the effect that a bill was being introduced by some labor interests requiring, if I recall correctly, that no steam boiler could be operated except by a licensed engineer. That was something which nobody noticed; it had generally escaped attention. The bill, as a matter of fact, had been introduced, was in committee and was being put through, and according to the word of the company operator who inquired in our office about it, it would place a serious burden upon the

small gas company and any other small operator who ran a steam unit in his company.

I did not know anything about it myself and referred the matter to one or two of our committee and they said, "That is tremendously important. Let us find out what there is to that." So it pays.

We had another interesting thing happen last spring which is rather characteristic of the type of service which the information director is constantly called upon to render to the small company. In a little town of about 4800 population, up in the northern part of our state, they had an election.

A few years ago a rather dynamic gentleman moved into the town who grew tired of the traveling circus business, bought the motion picture theatre on Main street, found the life tiresome and decided to get into politics and ran for mayor on the platform that he would investigate the gas company. The gas company was off in a remote section where railroad service was poor, freight rates were high, handling of coal at destination expensive, had an ordinance rate of $2.00 and very generously last year cut that rate to $1.90. The mayor somewhere had gotten hold of a statistical table of gas rates in our state, found that Detroit had a much lower rate than $1.90, that Jackson and Flint and Lansing were far below $1.90 and thought that that fellow up there must be getting rich on them. So he went off on an investigation and rode into office. Things were grand all that time and then he had to make good on his campaign pledge. I do not think it requires much elucidation about how well-fitted a traveling showman was to investigate the gas companies and find out about the gas rates.

After puttering around a while the people reminded him of his promise to investigate. One night when the lights were out he went to the house of the manager and said, "I have to investigate you." And the manager said, "Go ahead." "Well," he said, "what will I do first?" And the manager said, "Anything you like. Our office is over there. Go in now. Here is the key. If not, come tomorrow morning, the books are open, we have the records and you can see them. If I am called away, the girl will take care of you and give you anything you want to go ahead." He said, "I don't know anything about that." He finally said, "Won't you fix up something for me and I will see what I can do with it?"

That man had anticipated from the moment the votes were counted that the gas company would scurry to cover and would voluntarily reduce its rate and when that did not happen he did not know just what to do. Well, the manager was a little fellow who used to be in the potato business. His town is in the county seat of a very fine potato country and he did not know very much about it. He told them something about their pressure being so much per water column inches and so on, and finally he wrote to me and said, "I have got to submit a report and if the report looks all right the council will pass it unanimously and the mayor will sign it and the question will be filed away forever. Can you help us out?"

I looked up the company in Brown's Directory and looked him up incidentally in my own office and found that his company had contributed ten dollars for this year and the year previous to our committee work. I took the train out, spent a day and night with him and came back with enough dope to write a

twelve-page essay which I can guarantee did not say anything but sounded just grand. It went up there, was submitted the following week with a few minor errors fixed up, was unanimously endorsed by the council, signed by the mayor and the matter filed away and everything is fine.

Incidentally we managed to advertise that gas company. I sent a speaker up there later who addressed the Chamber of Commerce and he got an industrial customer. We told them a little bit about the distribution of gas and the problems of distribution by a man who was technically fitted to handle the subject, and some people who wanted gas and who had been slamming the company because they could not have it came across with part of the cost and so the system was extended.

In legislative matters, the little companies come to us all the time. We had one bill introduced in the last session which provided that gas companies in cities over a certain number of population—I think it was 50,000 or 75,000—would automatically be controlled by the state commission. The bill never got out of committee and nothing ever happened to it except that when it came out it got a couple of inches in the papers and everybody saw it. But a lot of men called up and said, "We have got valuable franchises. How about that thing?" And we were able, by having a point of contact, a place where those fellows could come, to keep them away from the state capitol and let the thing happen which always happens with ridiculous legislation,—it died. We are proceeding on the theory that anything which is not done properly the first time eventually has to be done over. Some one said something about going to the people, to the voters, with the facts. Who are the people and who are the voters? They are the gas consumers or the light consumers or the newspaper readers. They are the taxpayers and they are everybody else all rolled into one, one constitution and one entity and one set of folks, the people who read our bulletins or who denounce them and so on.

The Chairman: We will now hear a report from the committee of which Mr. Groce is Chairman.

J. B. Groce (Boston, Mass.): Your committee of directors having met, submit the following resolution:

It is agreed among the directors of the state information bureaus that they have difficulty in obtaining accurate statistics and material for stories in regard to the gas industry. It is therefore suggested that the American Gas Association as a national body, in order to avail itself of the full value of the work of these state committees, officially take this subject under consideration. It is the hope of the directors of these state information bureaus that more information in regard to the gas industry may be made available for the general good of the industry.

(The resolution was put to vote and carried.)

FINAL ADJOURNMENT.

MINUTES OF THE TECHNICAL SECTION

FIRST SESSION

Tuesday Afternoon, October 16, 1923.

The first session of the Technical Section was called to order by the Chairman, Mr. F. C. Weber, the attendance being approximately 400 members and guests.

(During the reading of the Chairman's Address, Mr. R. G. Porter assumed the chair.)

ADDRESS OF THE CHAIRMAN

F. C. Weber, New York, N. Y.

I want first to express my sincere appreciation of the splendid co-operation that has been given to me by the members of the Managing Committee, the Committee Chairman and by the American Gas Association headquarters staff. It has really been inspiring to be privileged to work with the various committees, and to observe how aggressively and progressively they handled the problems before them. The assistance received from Col. Fogg, Mr. Hartman and others of whom it was asked at the Association headquarters, has been of the highest order both from the standpoint of promptness and service. If you who are in attendance feel that the Technical Section has this year done work of value to you, please give due credit to all those, other than the Chairman, who have really done the big part of the work.

It has been the especial aim of the officers, the Managing Committee and the various committees to so direct and execute the work that the greatest degree of productive co-operation between all interested agencies may result.

The present administration has felt that there are many bodies not directly active in the gas industry, but who have an indirect interest and are in a position to be very helpful. I refer particularly to such agencies as the Bureau of Mines, the Bureau of Standards, the numerous technical schools throughout the country, and others. An especial effort has been made to enlist the co-operation and assistance of such organizations, and we believe that at least a substantial beginning has been made and that the future administrations can continue a close relationship that will be of mutual benefit and of especial advantage to the gas industry. The relations of the Section with the Bureau of Mines, which for several years has been especially happy, largely through the leadership of Mr. Fieldner, have been continued on a very satisfactory basis as is indicated by the valuable contributions to the program made by men of that organization. A

considerable step forward has been taken this year with the Bureau of Standards. Tangible progress with that body has been made on the problem of gas measurement, which applies to the question of large volume meters for station and industrial purposes, and to the matter of standardization of capacities of customers' meters. Substantial appropriations were made by the Executive Board upon resolution of the Technical Section, for research work in cooperation with the Bureau of Mines and the Bureau of Standards, and others.

The results of the interest that we have endeavored to arouse in organizations not specializing in our gas business, are specifically indicated in three instances on the program. These are the addresses of Dr. E. W. Smith of London, Mr. O. P. Hood of the Bureau of Mines and Professors W. K. Lewis and W. H. McAdams of the Massachusetts Institute of Technology.

Many of the members believe that there should exist a closer co-operation between the State and District Associations and the American Gas Association. We feel that the foundation, at least, has been laid for the development of this relationship, and in one or two instances, notably the Pacific Coast Gas Association through Mr. E. L. Hall, a rather definite step forward has been taken. If there is one point that I would particularly stress in a recommendation to the incoming administration, it is that they start immediately to stimulate the closest relationship between these territorial associations and the national body. There has, undoubtedly, been in the past much duplication of work, and furthermore there has not been an active clearing house through which the efforts of one or another of the associations has been directed to the attention of others or to the national organization.

Much thought and study have been given by committees and others to the desirability of setting up some scheme of succession that will make for continuity of their work. In the past, committees which often were in the midst of their most valuable work and findings were disbanded because the Association year had ended. Committees subsequently organized for similar activities experienced delays in being organized and in laying out the work, and frequently were not in a position to capitalize on the work of the previous Committee. The present administration therefore hands down to the incoming administration this problem as being one of especial importance, particularly with respect to such Committees as Carbonization, Program of Research, Deposits in Gas Pipes and Meters, Measurements of Large Volumes of Gas, Standardization of Capacities of Consumers' Meters, and others.

An endeavor has been made to keep apace with the chief problems of the industry by having ably organized committees, the reports and papers of which will speak for themselves. I feel safe in assuring you that such reports as are either presented here or printed elsewhere, will be found to be of an unusually high order of excellence and of the greatest value to the members. They give most complete and up-to-date information on many of the principal problems of the gas engineer.

Unfortunately time does not permit of the presentation here of the reports of all the committees. It is, therefore, considered desirable that as part of this address there should be made some reference to those reports that have no place on the program.

The report of the Committee on Cast Iron Pipe Standards, of which Walton Forstall is chairman, was published in the September A. G. A. Monthly.

The Committee on Disposal of Waste from Gas Plants was organized under the chairmanship of L. J. Willien, largely to be available as advisory, as requested. The report of this committee was published in the August issue of the A. G. A. Monthly.

The Committee on Specifications for Gas Coal, H. J. Rose, chairman, agreed with a committee of the A. S. T. M. on tentative standards, and these were adopted by the Managing Committee of the Technical Section. They were published in the June number of the A. G. A. Monthly.

A committee was organized with H. E. Bates as chairman, to make some study of the deterioration of holders. Various uncontrollable factors created delays (and, therefore, there is at this time not much more to be said than that the committee succeeded in organizing the work, and the next year should see some substantial tangible progress.

A committee with extremely important responsibilities is the one of Program of Research, of which Dr. J. F. Wing is chairman. The report of this committee will be published in detail in the A. G. A. Monthly very shortly. It will show that very valuable progress has been made in interesting district associations, technical schools, etc., in cooperating with the American Gas Association on research work.

I believe there are few agencies through which more constructive work can be done, than through such a committee acting as a clearing house on problems of gas research. I would especially recommend that some scheme of continuity be established in connection with this committee, so that it will always be in a position to recommend specific research problems for the consideration of technical schools. This procedure will also be of great advantage to the gas industry in training men for their needs.

REPORT OF THE NOMINATING COMMITTEE

The Secretary presented the following report of the Nominating Committee: For Chairman—L. J. Willien, Boston, Mass.; for Vice-Chairman—George H. Waring, Grand Rapids, Mich.

(Upon motion, duly seconded and carried, the report of the Nominating Committee was accepted, and the Secretary, as instructed, cast one unanimous ballot for the election of the officers as nominated.)

On invitation of the chairman they responded as follows:

L. J. Willien (Boston, Mass.): I cannot find words to express my appreciation of the honor conferred upon me. I appreciate that it involves considerable work along with the honor, and with the assistance of my excellent co-worker, Mr. Waring, and the cooperation of the members, it shall be my endeavor to maintain the excellent standard set by the section in the past and even to better it if possible.

To accomplish this, however, we need your cooperation and hope you can make it available to us as freely as you have in the past.

G. H. Waring (Grand Rapids, Mich.): I wish to thank you for this honor and assure you that I will do everything I can to assist Mr. Willien in the work.

THE REGIONAL SERVICE OF COAL

O. P. Hood, Chief Mechanical Engineer, U. S. Bureau of Mines

I am, perhaps, quite out of place here, since I can lay no claim to being in the gas industry, nor can I bring to you a message concerning anything not already well known to you. There are some advantages, however, in being one of an audience rather than a busy actor on the stage. The exposition of a point of view may be helpful, and there are many messages that need repetition in order to impress them. What I have to say is from the standpoint of one curious as to our inefficient fuel practices, and with a desire to help in raising the general level of fuel utilization through that department of the Government specially charged with fuel studies.

Coal an Object of Keen National Desire

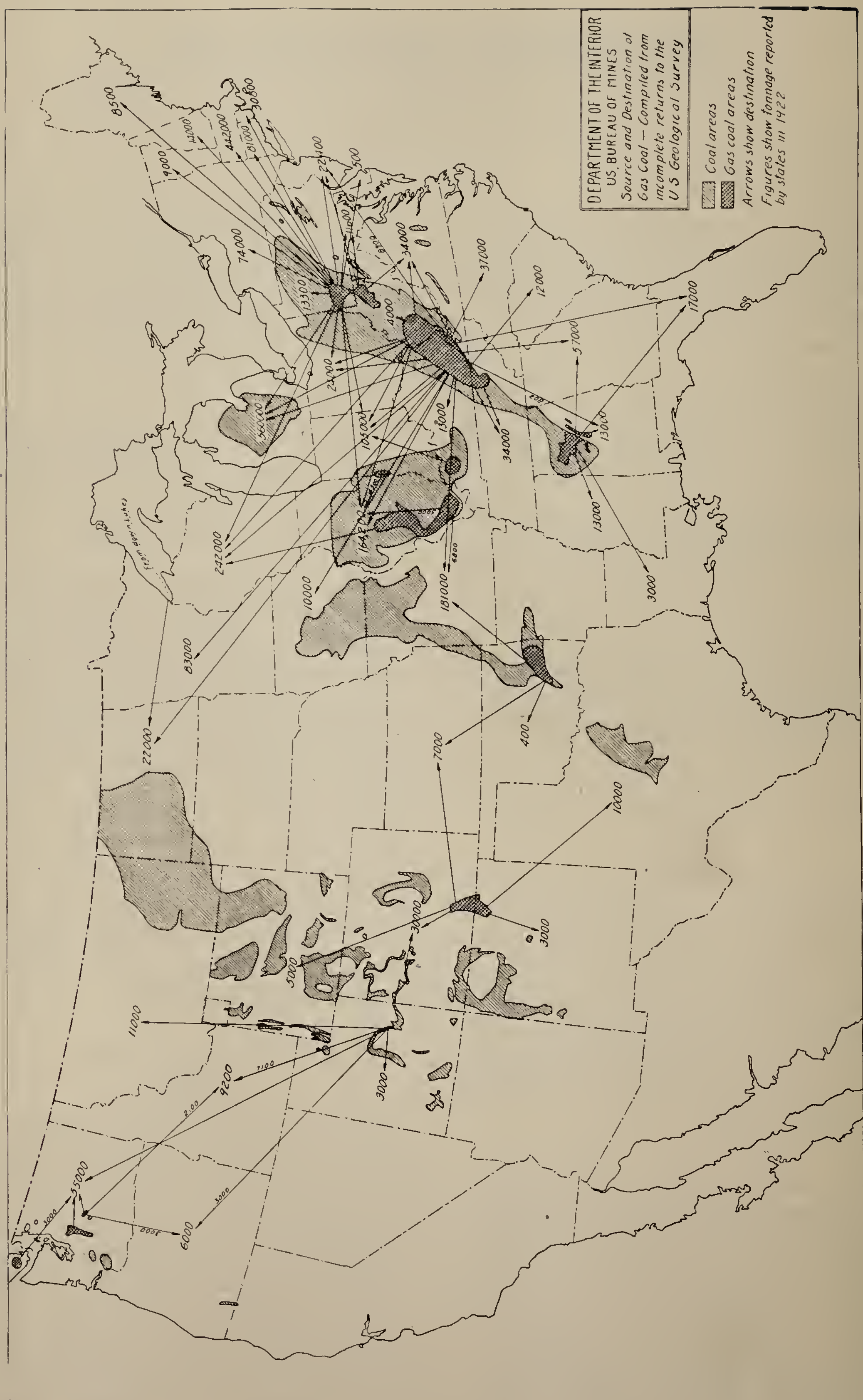
The events of the past few years have shown very clearly that coal is an object of keen national desire. Our abundant supply has made us the last to seriously realize this fact. Nations are feeling that the future belongs to those countries having coal and a knowledge of how to use it. Those without fuel are frankly envious.

Most fuel-producing nations have lately provided some sort of machinery for studying the technical and economic problems that have grown out of the production, distribution and use of this essential resource with the object of conserving the supply. England has a Fuel Research Board; Canada its Dominion Fuel Board, Mines Bureau and special boards; Germany has state-supported research laboratories and has a coal parliament. Switzerland maintains a small but efficient organization for the study of fuel problems. The U. S. Bureau of Mines is charged in its Organic Act with the duty of making investigations concerning fuels, and we have had our Fuel Administration, our Coal Commission, and a fuel distributor.

Fuel and its rational use has become a matter of community interest far beyond its mere dollars and cents relationships. From the nature of the resource it cannot be replaced, and fuels with special qualities are definitely limited in quantity. To use wisely this store of energy, which is shaping the outward forms of our present-day civilization, is, therefore, a national problem, and the gas man has an important part in it. He should discover wasteful tendencies and bad fuel habits, and substitute therefor something better.

The Intricate Situation Facing the Gas Industry

We have just had the reports of a talented commission appointed to study the problems of coal production. Intricacy and confusion are what they find in this phase of the problem. If a similar high commission were to consider our fuel utilization problem, the report would probably indicate a similar state. In the gas industry, the most desirable source of supply of fuel presents a prob-


DEPARTMENT OF THE INTERIOR
U.S. BUREAU OF MINES
Source and Destination of Gas Coal — Compiled from incomplete returns to the U S Geological Survey
Coal areas
Gas coal areas
Arrows show destination
Figures show tonnage reported by states in 1922

lem much more intricate than it should. If the flow of gas coal from each producing center to each gas plant were shown on a map, the intricacy of the situation would be obvious. This is partly illustrated in the accompanying map which shows the several areas of production of gas coal and where it goes, insofar as incomplete returns to the U. S. Geological Survey will show.

A study of this map shows that special coals from distant fields are hauled across and beyond other major coal fields. The Western Pennsylvania field supplies not only a region to the north and east, which its geographical position would warrant, but it flows to Indiana and to Illinois in the face of an abundance of other coal. The East Kentucky fields supply not only the immediate vicinity and the natural territory to the southeast, but send across the central coal fields to Iowa, Missouri, Indiana and Illinois. The State of Washington has coal, but it gets its gas coal largely from Utah. All coal used in Illinois is hauled an average of about 170 miles, while its gas coal is hauled 400 miles. Missouri coal is hauled 180 miles, but its gas coal rides 450 miles. Iowa coal pays freight on 170 miles, but its gas coal pays for 600 miles.

Limitations Compel Use of Special Fue

The reason for this is not far to seek. The public utility maker of gas cannot always use the most available fuel, although it is well known that every user of a fuel first produces gas and then burns the gas he has made. The furnace under the steam boiler is only a producer of gas and a device for burning this gas. The interval between production and utilization is very short, and the distribution function is at a minimum. The man, however, who separates the production of gas from its immediate utilization, and takes advantage of its extreme mobility to distribute it over a large area, must pick and choose a special fuel, often going far afield for it. Limitations, technical, commercial and legal, compel him to use this very special fuel, although usable gas could be made from almost any fuel.

The practice of the time makes him seek a coal high in volatile matter, low in sulphur, and with a quality that will make a saleable coke. Typical analyses are shown in the table. Such coals have come to be called gas coals, and the quantity available is limited. Insofar as available processes limit him to such special fuels, these extra long and cross hauls may be justified, but the development and use of better processes is retarded by a confusion of standards of gas that take no account of the most available fuel.

These standards often require the continuance of another most intricate system of distribution, the distribution of an oil distillate added to that of the gas coal, so that the industry is partly dependent on the hazards of petroleum production. Oil must now be used to raise the heating value of the gas to some arbitrary standard fixed largely by convention and obsolete domestic equipment. It is extremely desirable that such arbitrary and unnecessary limitations be removed from the gas industry in order that the benefits of an extended use of cheaper gas may be enjoyed, and that economic waste be reduced.

Inflexible Standards Directly Opposed to Public Interest

The fundamental problem before the industry should be that of furnishing

the greatest heating value in the form of gas at the least possible price per heat unit consistent with good business. The public has gained the impression that this has not always been the aim of gas companies. Ears are, therefore, dulled to those technical arguments that would induce them to lower the B.t.u. standard of gas. This is unfortunate, because the maintenance of such standards may be directly opposed to the public interest.

The consumer should realize that the heating value of the gas-air mixture, which is ignited at the surface of his burner, is somewhere in the neighborhood of 90 B.t.u. per cu. ft., whatever may be the heating value of the gas before the consumer dilutes it with air, and that the temperature of the flame may be even higher with the lean gases that require the less dilution.

It is not necessary or desirable for equally satisfactory service that every community should have the same kind or grade of gas. Illustrations of perfectly satisfactory service can be found with gases ranging from 300 B.t.u. per cu. ft. up. The accompanying table shows the heating value of several gases as diluted for use at the burner.

Colorado Sets Worthy Example

Uniformity of quality and proper adjustment of apparatus are much more important to the consumer than a high heating value standard. He should be able to buy gas on its heat value rather than by its bulk, and the gas manufacturer should be free to declare a standard for gas which will enable him to use the most available fuel and one naturally tributary to the district in question. These are the factors most important to the consumer. There will follow a greater usefulness of gas, a lower cost of production, a more stable supply of fuel, and a better use of our transportation systems, all desirable objectives.

When each coal field shall satisfy the needs of a region naturally tributary to it, with a minimum of transportation charges, an ideal condition will have been reached, and it should be the aim of technical processes, community habits and legal enactments to approximate this condition. It is very fortunate that one state in our Union (Colorado) has lately taken this point of view, and it is hoped that the service received by the public under this more rational and liberal law will be so conspicuously satisfactory that it shall speedily become the universal practice.

ANALYSIS OF GAS COALS

Compiled by Geo. S. Brewer

Coal	Moist.	Vol.	F. C.	Ash	Sul.	B.t.u.
Western Pennsylvania "Westmoreland Gas Coal"	...	36.33	58.11	5.56	.81	14,274
West Virginia (Northern), (Fairmount)	1.15	35.35	57.10	6.40	.95	14,300
West Virginia (Logan Co.)	1.20	33.50	59.80	5.50	.85	14,280
Eastern Kentucky "Elkhorn"	3.40	36.75	55.85	4.00	.75	14,000
Tennessee	2.00	37.25	56.00	4.75	.85	14,100
Alabama	3.50	32.50	54.60	9.40	1.00	13,200
Oklahoma (McAlester)	2.00	37.25	56.25	4.50	.75	13,500
Colorado (Southern)	2.54	36.08	49.14	12.24	.69	12,227
Utah (Sunnyside)	5.50	39.20	47.80	7.50	.60	12,500
Washington (Roslyn)	8.00	34.60	44.70	12.70	.45	11,410

TABLE SHOWING CALORIFIC VALUES AND THEORETICAL FLAME TEMPERATURES OF THREE SIMPLE GASES

Computed by Geo. S. Brewer

	Complete Combustion of Carbon Monoxide	Hydrogen	Methane
B.t.u. per cu. ft. of gas, 60° F., 29.9 in. (gross value)	323	325	1008
B.t.u. per cu. ft. of gas-air mixture as burned	92	93	92
Theoretical flame temperature, °F.	2650	2550	2450

TABLE SHOWING CALORIFIC VALUES OF GAS-AIR MIXTURES OF THREE TYPICAL COMMERCIAL GASES

Computed by Geo. S. Brewer

Constituent Gases	300 B.t.u. Water Gas Per cent by Volume	B.t.u. per cu. ft. as burned	600 B.t.u. Carb. W. Gas Per cent by Volume	B.t.u. per cu. ft. as burned	450 B.t.u. Coke-ov. Gas Per cent by Volume	B.t.u. per cu. ft. as burned
CO_2	8.2	...	4.8	...	3.2	...
Illuminants	1.4	1.4	12.8	12.7	3.0	3.0
O_2	0.3	...	0.3	...	1.0	...
CO	34.0	31.4	29.2	26.9	9.6	8.9
CH_4	1.9	1.9	14.2	14.0	22.8	22.6
H_2	50.4	46.8	35.0	32.5	41.5	38.5
N_2	3.8	...	3.7	...	18.9	...
Total	100.0	81.5	100.0	86.1	100.0	73.0

The Chairman: We are immensely indebted to Mr. Hood for delivering so pregressive a message. Certainly we have something very substantial to present to regulatory bodies in our effort to secure selective standards when a representative of the Bureau of Mines declares such practice to be economically correct.

The Colorado commission recently granted a selective standard, permitting gas companies to make gas of such calorific value as they chose, only requiring a guarantee of good service. Our organization is now making about 375 B.t.u. gas in Denver and giving better service than we have given with any other quality of gas.

(A vote of thanks was extended Mr. Hood.)

During the presentation of the report of the Committee on Carbonization and Complete Gasification of Coal, Mr. R. G. Porter assumed the chair.

REPORT OF THE COMMITTEE ON CARBONIZATION AND COMPLETE GASIFICATION OF COAL

R. G. Porter, *Chairman,* Chester, Pa.

Introduction

The work of your Carbonization Committee, for this year, has been divided into the same sections as last year; namely,

Operators
Complete Gasification of Coal
Low Temperature Carbonization
Builders

These sections, this committee feels, should be continued next year.

The question did arise as to whether complete gasification of coal warranted a separate section, which was brought about solely by the fact that there was a lack of processes to be found that have reached a stage of development where operating figures are available for this report.

This section, however, has done a great deal of valuable work in their process of elimination and, therefore, should be continued. Any activity is valuable that keeps the Industry advised as to such developments as are available in this field, and we should not close our eyes to new theories and possibilities, but have men prepared to observe and study them, and then give us the benefit of their work.

Professor Demorest's carbonizing tests comparing results obtained using run of mine and ¾″ screened coal, are embodied in this report, and have been completed most satisfactorily.

The question of research, as far as it pertains to the work of this committee, has been discussed at some length with a view of possibly obtaining a fixed sum each year from the Association, to be applied on such work as may be deemed advisable, and also to insure the continuity of such work from year to year.

We must admit that research and development demand in most cases, immense amounts of money, in order that such work be conclusive and worthwhile. Let us not attempt to set any fixed sum required for research from year to year, but rather carefully select vital and fundamental problems. A subject truly worthy of research is also worthy of courageous effort to obtain the required funds to carry on the work. Unless we face this subject squarely, we will be likely to find ourselves permitting those outside our industry to do such work, while we ultimately must pay the bill, but with the addition of interest charges on the money expended in the form of profits.

When research is contemplated, let us carefully consider:

(1) Whether the information is of sufficiently fundamental importance to warrant its cost in view of the other demands within the Association for research;

(2) Whether, when undertaken, there is a reasonable possibility of accomplishing practical results;

(3) Estimate as accurately as possible the expense involved, taking into consideration whether the existing gas companies, or outside research facilities are available for the work and interested in cooperating with us;

(4) Probable time required for the work and when an appropriation is necessary what proportion of the appropriation will be spent in the fiscal year.

A recommendation after such consideration, outlining fully the need of research, and placed before the Managing Committee of our section, as to how and when the appropriation will be disbursed, will undoubtedly receive most careful consideration, and if approved by them, they will draft a resolution to be presented by the chairman to the Executive Board for final action.

The continuity of the work of this committee, from year to year, has been a subject brought up several times in the past, as well as the loss in time each year during the process of forming a new committee on a working basis. Rather than establish any set rules of procedure, we have adopted the suggestion of our secretary. It was his idea that the chairman should prepare, prior to the Convention each fall, a letter for the incoming chairman. This letter should give a brief outline suggesting work to be carried on into the next year, and also propose a number of members of the committee, who, on account of their work during the past year, are especially equipped to act as chairmen of the several sections of the new committee.

We hope this procedure will materially aid in the rapid formation of the new committee, and yet in no way hamper the incoming chairman by any fixed rules of procedure, had they been adopted.

The work which your committee has been able to accomplish this year is presented in the following pages under the sectional headings heretofore enumerated, with the exception of a paper prepared by Mr. A. W. Warner, which follows immediately after this introduction.

The attendance at Committee meetings and interest shown by the members has been most gratifying, and they all deeply appreciate the assistance given by our secretary.

A STUDY OF SOME PHYSICAL LAWS GOVERNING THE CARBONIZATION OF COAL

A. W. Warner, Chester, Pa.

The years of experience in the carbonization and gasification of coking coal have brought forth three fundamental processes, typified by coke ovens, low temperature carbonization and complete gasification—prime quality coke, prime quality oils and maximum gaseous B.t.u. Between these conceptions are a multitude of variations. From a ton of coal the coke oven produces some 10,000 cu. ft. of 550 B.t.u. gas, 12 gal. of degraded tar and the best grade of low volatile coke; the low temperature process produces some 4000 cu. ft. of 1000 B.t.u. gas, 23 gal. of oils, and a high volatile coke or coalite residue; while complete gasification produces gas of varying volume and composition, 23 gal. of oil and no coke. The gas from this last process is necessarily of too low a B.t.u. quality to distribute economically in our present distribution systems.

In studying the basic physical and chemical laws governing the phenomena of carbonization, it would appear that a fourth distinct and fundamental process is possible whereby the low volatile close-grained coke of the coke oven may be retained, the 23 gal. of low temperature and complete gasification oil, and also a yield of 8000 cu. ft. of 700 B.t.u. gas. This gas yield, it would appear, can be obtained by adding to 4000 cu. ft. of low temperature gas, the gas from the high volatile coke of the low temperature residue.

We have devised two pieces of crude apparatus to show how a fourth fundamental process can be applied to the carbonization of coking coal. From the experiments with this apparatus we have deduced the following five basic laws governing carbonization:

I. If removal of volatile matter from coking coal were the only consideration, the high heats commonly used in carbonization are unnecessary.

II. The condensible hydrocarbons of coal are more valuable as raw products the nearer to their primary state they exist because no way has been found to convert any but a meager portion of them into permanent gas.

III. The less the cracking, and the more the distillation of condensible hydrocarbons occurs, the less will be the intensity of heat required to drive off the volatile matter of coal.

IV. The less the heat through which the gases from the noncondensible hydrocarbons must pass in leaving the retort, the richer will be the gases and the greater the B.t.u. feet from this source per unit of coal.

V. The closer the ideals of IV are met, the greater will be the possible

cubic feet of mixed gas of a determined B.t.u. per unit of coal.

* * * *

I. If the removal of volatile matter from coking coal were the only consideration, the high heats commonly used in carbonization are unnecessary.

* * * *

To bring this fact clearly before the eye, low temperature oils from a given coal were collected having a boiling point range from 660° to 750°. These temperatures were selected because R. V. Wheeler and M. J. Burgess have drawn the following conclusions from their experiments on low temperature distillation of gas coal:

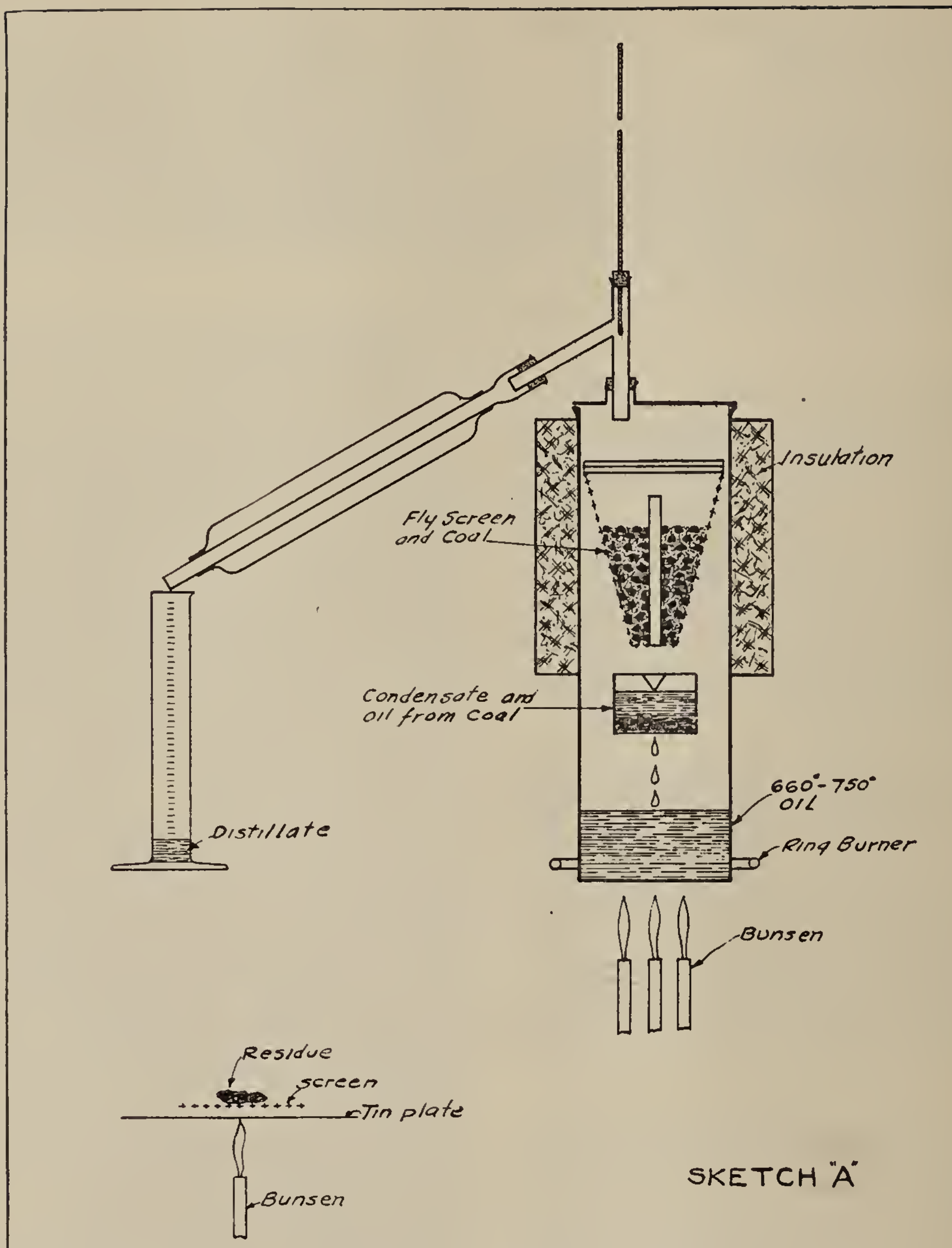
"That liquids other than water begin to distill over as a reddish brown oil at 600° F. but inasmuch as its appearance is unaccompanied by any marked evolution of gas, it is liquidated out of the coal conglomerate rather than as a decomposition product of the coal substance."

"That a critical decomposition point is reached at about 660° F. which is marked by a rapid increase in the gas evolution and the appearance of much viscous oil."

With these 660°-750° oils at hand, some interesting physical experiments suggest themselves to the curious-minded. These oils were placed in a glass distilling flask in the neck of which was suspended a fly screen wire basket containing some twelve grams of coal. As these oils were made to slowly distill over, the coal was naturally caused to slowly rise through a predetermined temperature range (660°-750°) and further to do so in an intensified atmosphere of the same liquid and vapor hydrocarbons as were present when these oils were driven from the retort. Thus it was possible to study under glass this critical decomposition point (660°) where all the physical characteristics could be observed by the eye.

Gas coal treated in this way suddenly commences at 660° to come out through the wire meshes and to slowly drop off in bubbling mats into the boiling oil. At the same time, the condensing oils themselves assume a dirty brown color. This phenomena continues with rising temperatures until the oils are distilled over. The gas evolution becomes more and more pronounced. Some vapors evolved at this time settle toward the oil surface, which is not surprising when you consider that ethane has a specific gravity of 1.038. The residue in the basket was found to be a dryish, greasy graphite-like substance possessing no coking characteristics but rich in gas-making constituents. The oils, containing the wash from the coal, when carried to oil coke left a residue rich in gas and possessing considerable coke-forming constituents. A tremendous amount of lamp black was formed in burning any of these gas-making constituents.

We next built a tar still 5″ dia. and 20″ high, the top of which took the same lid and glass-distilling apparatus as an ordinary tar still. The sides were thoroughly insulated except the first seven inches from the bottom. A fly screen cone-shaped basket provided with a ½″ tube up through its center was made. Suspended from the bottom of this was a tin boat. 600 cc. of 660°-750° oil were placed in the bottom of the still and 180 grams of coal were placed in the basket. The general ar-



rangement and method of heating are clearly shown in sketch "A."

Two tests were run with this apparatus. In each case the coal was screened—through ⅜″ mesh and remaining on the fly screen which formed the basket used in this test. In the first test, as soon as a steady distillation was established (30 cc. of oil and water), the charge was pulled. We wished to look at the coal and determine the amount of oil it had absorbed. The coal was entirely softened. The lumps had disappeared into a conglomerate tarry mass which could be stirred when hot. The coal had absorbed 85 cc. of oil. In the second test, distillation was continued until 200 cc. of oil had come over. It was found that the 200 cc. of oil had refluxed and come over before 650° was reached. Upon redistillation in a glass flask, 100 cc. came over under 650° while 80 cc. came over above 650°, leaving a 20 cc. equivalent residue in the flask and for distillation loss. The coal in the basket had shrunk to less than half the original volume and

weight. The boat (which was empty at the start) was full, its capacity being 175 cc. of oils. Those oils on top distilled at 670°, while in the bottom of the boat was a thick sediment of viscous oil resembling pitch which had melted and run down from the coal. In the bottom of the still were 300 cc. of heavy black tar. From the boiling point of the oil in the boat, it is apparent that, up to the conclusion of the test, no heat above 670° had been applied to the coal.

The residue both in the basket and in the boat contained much volatile matter—practically all non-condensible. To remove this volatile matter and to get some idea of the intensity of the heat required to drive it off, a piece of sheet tin was heated to a very dull red over a bunsen burner. About ⅛″ above this sheet, which was large enough to avoid danger of igniting the gases, was placed a piece of fly screen. On this screen were placed the two samples of residue. The gas evolution was rapid, the pieces of coal residue retaining their original cold color until the gas had been driven off. Thereupon they instantly came to a glow—a particle here and a particle there according to which particle was first freed from its volatile. In neither residue were there any signs of condensible vapors or lampblack. This heat was not over 1050° F. and was capable of taking the entire residue to carbon and ash.

Before leaving these tests, it might not be amiss to describe another phase of carbonization studied with this type of apparatus. Certain low temperature oils below the 660° boiling point contain upwards of 30% tar acids. These acids (boiling point up to 450°) were separated from the oil in the usual way and placed in a glass distilling flask provided with a wire basket as in the previous test. As these acids were caused to slowly distill over, the coal became thoroughly washed with the acids of each boiling point. As long as oxygen was present, these acids kept washing out from the coal a dirty brown substance. As often as the distillation was stopped and air could reach the basket, the restarting of distillation caused a further washing. If a small stream of oxygen were introduced into the space above the boiling acids, the wash flow was continuous. At no time up to 4 hours did the washing cease. These acids taken to coke, left a residue which, when heated in a crucible, puffed up into a hornet's nest not unlike a Fourth of July "snake in the grass." The coke structure of the remaining coal was materially improved by this washing. This frothing residue added to ordinary boiler coal produced a very fine coke formation in the crucible test. This test opens a line of thought as to the influence of the high oxygen content of Illinois coals on their coke formation.

We, therefore, come to the conclusion that at a temperature under 700° F. coal can be completely softened and its coking properties disappear. Under certain conditions, a heat under 1050° F. can drive off practically all of the volatile matter from coal.

* * * *

II. The condensible hydrocarbons of coal are more valuable as raw products the nearer to their primary state they exist because no way has been found of converting any but a meager portion of them into gas.

* * * *

The primary tars from coal are largely high boiling point oils. The lighter

constituents we usually associate with coal tar products are products of later decomposition which have left behind free carbon as well as still higher vaporization point residues. Once these primary oils are separated from the coal in the primary stage, they can be more accurately controlled for further splitting up into products that may be desired in special apparatus designed for this purpose than in any high temperature carbonizing process known. In low temperature coal distillation or its equivalent, there is obtained at least twice the tar yield that high temperature gives. The nearer the primary stage the oils are obtained, the higher the proportion and content of tar acids, creosoting oils, anthracene, etc., will be before pitch of a desired quality is obtained. In our experiments, we have produced from the same coal by varying the temperatures of carbonization and the retort atmosphere, tars distilling 97% oil and 3% oil coke, down to tars distilling 30% oil and 70% coke.

Let us take a fair tar sample—79% oil and 21% oil coke. Distillation of this particular oil showed that it was possible to distill 50% as oil and leave a remainder of 145° F. melting point pitch. Two samples of this 50% oil were saved—one sample as distilled over and one sample washed free from its tar acids. These samples were cracked in a gas oil testing machine at 1500° F. in an atmosphere of blue gas with the following results:

@1500°	Without tar acids	Including tar acids
Oil per M.	2.90	2.91
B.t.u. mixed gas	406	416
Oil gas per gal.	37.2	46
% to tar	16.4	21.8
Tar	Much Naphthalene	Odor Naphthalene
B.t.u. oil gas	1,360	1,230
B.t.u. feet per gal.	50,700	56,600
H_2SO_4 absorbs from oil	70%	—

The question has been repeatedly raised as to how much the possible gas yield has been robbed in obtaining the less degraded tars and oils in the various low temperature process. We can make some approximation from these results if we may assume that these products, sent through the 1500° atmosphere of hydrogen, or their equivalent, were all existent at some time in the ordinary high temperature retort and most of them passed through a temperature range up to and beyond 1500°. They probably could not contribute much more to the final high temperature gas and tar than they did to the blue gas.

Roughly 10 gal. oil—83 lbs. give:

18.0 lbs.	tar	22.0%
32.0 lbs.	gas	38.0%
33.0 lbs.	carbon, etc.	40.0%
83.0 lbs.		100.0%

or possibly 1000 cu. ft. of 566 B.t.u. gas.

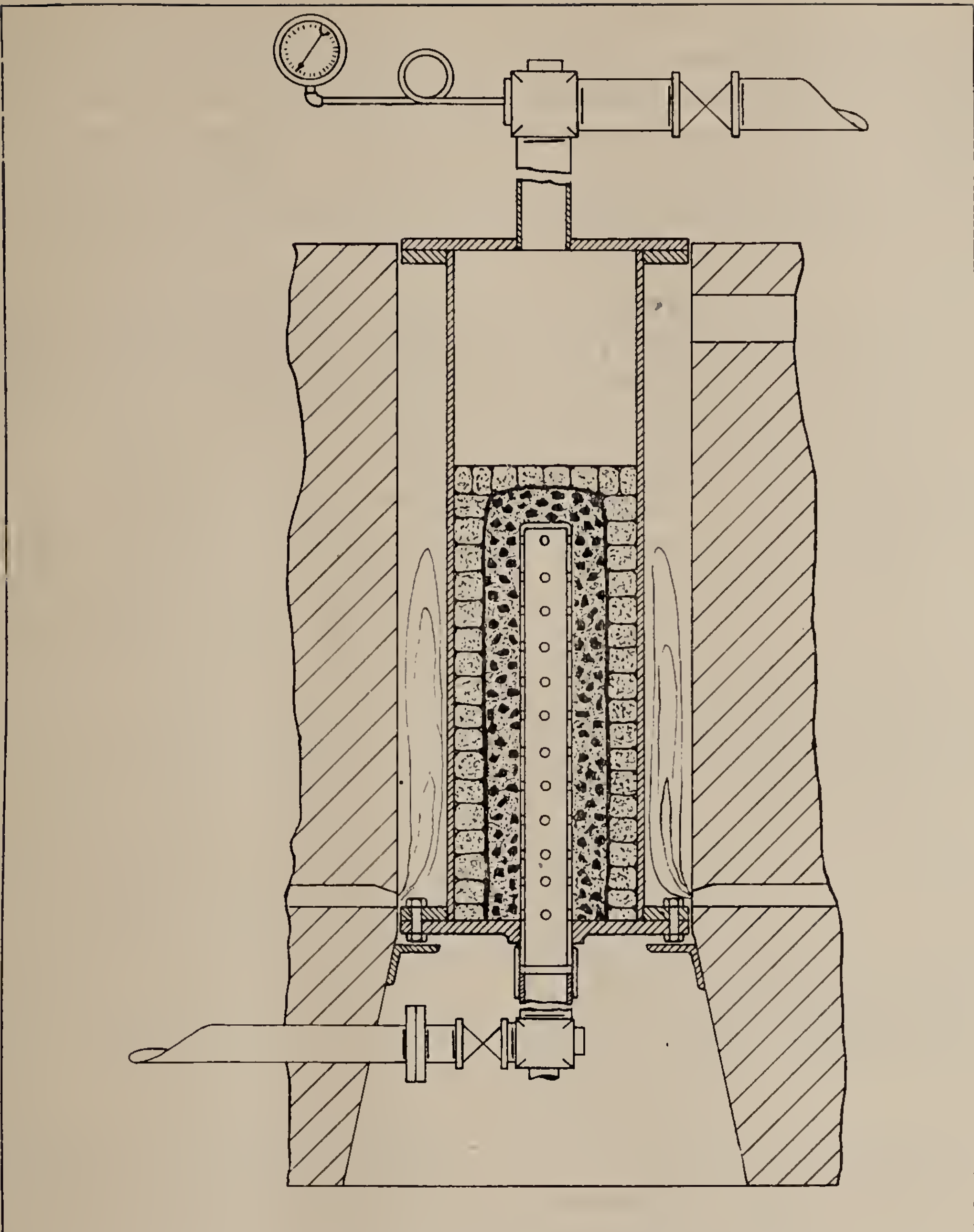
This result—1000 cu. ft. of 566 B.t.u. gas tallies closely with the conclusion of most investigators as to the contribution of tars to high temperature gas yields. Therefore, obviously it is far from economical to ruin 83 lbs. of low temperature oils for 1000 cu. ft. of 566 B.t.u. gas equivalent. There must be some way to save low temperature oils and at the same time drive off the rich volatile matter remaining in the coke.

* * * *

III. The less the cracking and the more the distillation of condensible hydrocarbons occurs, the less will be the intensity of the heat required to drive off the volatile matter from the coal.

* * * *

In view of the tar still tests and to carry on the study of the intensity of



SKETCH "B"

heat required to drive off volatile matter from coal under various conditions and to study the physical characteristics of the gas, tar and coke—a very simple carbonizing apparatus was designed. This is diagrammatically shown in sketch "B."

In the carbonization of coal in an oven, there is formed a plastic film between the coke already formed and the uncarbonized coal. Its temperature must be between 660° and 750°—say 750°. As heat is applied through the inside wall of the retort, this film progresses inwardly toward the center of the charge. This film may at times interpose a resistance of as high as 30″ to 40″ (water) to the flow of gas and vapors.

(Vide Evans*) This carbonizing apparatus is of such design as to cause this film to form an inverted bell in the center of which is placed a vented duct. The outlet from this duct is led from

*Technical Section, Sessions of the American Gas Association, Vol. II, 1920, pages 116 and 135.

the bottom so as to be protected from the action of any external heat. Through this outlet the inwardly traveling heat drives off the oils and vapors borne up to this 750° temperatures as well as such gases as find their easiest egress by this path of travel. The residue of this plastic film is simultaneously carbonized at some higher temperature. A top retort offtake provides a means of collecting and removing such of these gases and vapors as find their easiest egress through this path. Suitable exhausting and scrubbing means must be provided to take care of the gas.

It is apparent that this apparatus gives us a means of studying the influence of distillation and cracking on the intensity of heat required and the final mode of existence of the products. If the top outlet be closed and a slight exhaust suction be maintained in the inner duct, pressure readings under the top lid will give some idea of the resistance to flow of the plastic film. At times this rose to 12″ hg., instead of bringing coal through a varying range of temperatures we passed a varying range of temperatures through a stationary charge of coal. By establishing the proper pressure balance between the top and bottom outlets, we could recover practically a full yield of low temperature oils and drive off the volatile matter from the remainder at any temperature desired from 1000° F. up. This lower possible temperature range was available because little heat was used in uselesly cracking the low temperature oils and revaporizing the heavy residues therefrom. We could throttle the bottom outlet and leave the top outlet open. This enabled us to approach high temperature retort practice. A comparison of the carbonizing time with the same intensity of heat—with and without cracking— indicated how unnecessary are the high heats used in ordinary carbonizing practice. In every test where excessive cracking was avoided, the time of carbonization was cut almost in half.

It is evident that each time a condensible hydrocarbon of a given vaporization point is cracked there ensue three physical products—a light oil, a heavier residue and free carbon. The heavier residue, upon further accession of heat, in turn, splits up into a lighter oil, a still heavier residue and more free carbon. With each accession of heat causing cracking, more and more must become the heat necessary to drive off the final volatile. In such tests as we can be sure all the condensible hydrocarbons are educted away from the heat, a low temperature incidence drives off practically all the volatile matter from the coal residue right up to the edge of the plastic mass of the carbonizing coal. However, if the pressure conditions be such as to force these vapors out through the heat, the time required for carbonization becomes much greater as well as the amount of residual volatile. A physical separation of the condensible from the non-condensible hydrocarbons it would appear is even superior to a vacuum method of distillation because in a vacuum distillation the conditions in the mass vary according to the coal sizes. (Vide Tozer tests.*) Cracking the primary oils not only wantonly breaks down valuable oils into 4% of gas plus degraded tar and free carbon but also calls for an enormous and useless expenditure of carbonizing heat to obtain any rapidity of throughput at all. Perhaps the following crude test will more clearly bring out this point. A sample of tar—79% oil and 21% oil coke—

*Proceedings of the American Gas Institute, vol. VIII, 1913, page 669.

was distilled in a copper still with the ring burner set above the level of the oil but too low to carry the vapor fast enough to the condenser. This cracking test demonstrated that some 33% of the oil could be distilled over before reaching the temperature of the first drop in the original distillation. However, it was found that only an additional 17% of oil could be distilled before oil coke was reached.

In a carbonizing chamber such as was used in these tests, it is evident that we have indicated one way to carbonize a relatively high amount of coal per square foot of retort surface with comparatively low temperatures at the retort walls and to protect the primary oils to a degree at least approaching the oils of low temperature vacuum carbonization. We pass heat from a constant source of supply through the charge progressively and withdraw the gases and vapors by two paths—one protected from the heat and one exposed to the heat. Therefore, we carry on simultaneously two diametrically opposite gas-making processes. Such inwardly flowing gases and vapors as are condensible, condense and repeatedly come into contact with oils and vapors condensed at lower temperatures. As the inwardly traveling heat progresses, the gases undergo an oil scrubbing treatment. In this way, at least, all the oils and vapors formed up to 750° (and these include practically all of the condensible hydrocarbons) escape, driving ahead of them all of the water vapor. The coal at the same time receives an acid washing similar to that already described. The outwardly flowing gases, freed from these more unstable, high vaporization residue-leaving constituents, are formed under more ideal gas-forming conditions. These gases and vapors mix with gases of a higher hydrogen content and can be made to pass through the range of rising temperatures most suited to the ultimate formation of stable gas, high in ethane, methane and illuminants.

It has been generally accepted as a fact that the ability of coal to absorb heat is greater than the means of bringing heat to the coal because the heat must fuse or vaporize one particle of coal before it can pass on to the next. We find during the progress of carbonization 900° (2% vol.) coke and 200° coal separated by a plastic film 3/8" thick. This type of carbonizing chamber increases this ability to absorb heat to a maximum by avoiding the needless cracking of condensible hydrocarbons remaining between the source of heat and the film.

The heat penetrating the retort walls and used in high temperature carbonization is usually proportioned about as follows:—

Decomposition and distillation	37½%
Heating gas and vapors	26½%
Sensible heat of the coke	36 %

All gases and oils passing within this film are never reheated above their vaporization point or broken up. The film avoids the necessity of a fixing chamber and becomes as it were a scrubber and a condenser for these gases. All the hot vapors passing from this 750°-200° film must condense and recondense coke-forming constituents. The larger the gas flow in this direction the better must be the coke formation. As all the water has been driven inwardly ahead of the oils, and the frothing constituent has been washed out by the acids, the coke-forming residue must be quiescent

and free from frothing. With this method there can be no fear of swelling coals. Nor has mass under these conditions much to do with the coke formation. All gases and vapors passing inwardly must have been heated above 660° and, therefore, they must give up a major portion of their heat in passing inwardly, helping the film in its inward travel. The fuel required for heating the gases and vapors should be cut away below that required for other high temperature processes. In fact, most of the water in the coal escapes as vapor and not as steam. With this method of egress the oven heat must form the film before raising the temperature of the water vapor, thus preventing too slow volatilization of coke-forming constituents and giving a maximum duration of heat for graphiting the coke. Thus we see that this form of test apparatus can avoid, to the utmost, cracking of the oils and give us a clear idea of the relative intensity of heat required for carbonization with and without cracking. It makes possible the simultaneous production from coking coal of full yield of gas, a full yield of low temperature tars and a low volatile close-grained coke.

* * * *

IV. The less the heat through which the gases from the non-condensible hydrocarbons must pass in leaving the retort, the richer will be gases and the greater will be the B.t.u. feet per unit of coal.

* * * *

So much has been written on the subject of the influence of heat on hydrocarbons and so conflicting have been some of the deductions that it is not necessary, at this time, to review this subject. However, it is essential to bear in mind that in ordinary methods of high temperature carbonization there seems to be a critical temperature between 1300° and 1500° where the rate of gas evolution and the quantity per pound is nearly double at 1500° what they were at 1300°. Above this critical range of temperature the evolution of hydrogen rapidly increases. The evolution of hydrocarbons of the paraffin series practically has ceased at 1300°. Methane is very stable up to 1500°. The carbonization problem, therefore, has been one of keeping the hydrogen content of the gas as low as possible consistent with driving off the volatile matter, because it has been felt that high hydrogen indicated uneconomic cracking of high B.t.u. gas constituents.

The following table (Jones & Wheeler) clearly shows the influence of heat on low temperature tars.

Low Temperature Tars.

Temp. °Fahr.	Higher Olefines	C_2H_2	C_2H_6	CH_4	H_2
1020	21.7	0.7	18.2	19.6	29.4
1110	12.5	1.3	11.3	33.9	33.6
1200	11.4	0.9	12.0	39.0	27.4
1290	8.2	1.3	2.4	43.8	26.2
1380	0.7	1.2	1.2	56.1	33.2
1470	1.0	1.3	—	33.0	60.7

Professor Lewes shows the influence of heat on the final gas about as follows:—

A ton of coal yielding 4000 cu. ft. of gas under ordinary low (1100°) temperature carbonization, yields 10,000 cu. ft. of gas in high temperature (1800°) horizontal retorts. The residue after low temperature carbonization, heated to 1800°, yields 4500 cu. ft. of gas. We may assume the 10,000 cu. ft. of gas to have been made up as follows:—

Primary gas	4000 cu. ft.	40%
Degradation (11%)	440 cu. ft.	4.4%
Residue in coke	4500 cu. ft.	45.0%
Gasified tar	1060 cu. ft.	10.6%

Our experiments have shown us that it is economical to drive off the volatile from coal at a temperature of 1470° and

even lower and that the condensible tars (oils) can, at the same time, be driven off away from the heat at 750° F. and lower. Therefore, referring to the above example, it must be possible to obtain the full gas yield from the non-condensible hydrocarbons with far less degradation of the primary gas. There should be no gasified tar but in its place oil removed at low temperature for more suitable economic uses. An ethane content of 8% is not unusual for gases evolved in these tests with a retort wall temperature of as high as 1470°. Such gas contains absolutely no trace of naphthalene. As the complete range of carbonization from rich low temperature gas to lean gas from the residual volatile is continuously taking place within the narrow range of the plastic film, there is practically no change in the B.t.u. content of the gas from start to finish of the charge. Once these heat reactions (1020°-1470°) on low temperature tars are obviated and degradation of the primary gases is brought to a minimum, the study of gas from the coke residue becomes simplified: The presence of high vaporization point relics of the condensible hydrocarbons in the coking residue from high temperature carbonization so changes the retort atmosphere in the mass as to require high temperature to drive off the remaining volatile. So far as driving off the non-condensible hydrocarbons goes, no such temperature as 1300°-1500° is necessary. The ultimate products of the multitude of constituents in coal are materially influenced by factors other than the distillation temperature. We must know the atmosphere, pressure, and temperature at the moment of formation. As cracking invariably means a loss in gaseous B.t.u., it becomes evident that this process must give the maximum B.t.u. feet of gas from the non-condensible hydrocarbons.

* * * *

V. The less the heat through which the gases from the non-condensible hydrocarbons must pass in leaving the retort, the greater will be the possible cu. ft. of mixed gas of a determined B.t.u. per unit of coal.

* * * *

This last proposition is largely a problem in arithmetic. Owing to the removal in gaseous form of practically all of the volatile residual in the coke, the gas in our tests averages some 700 B.t.u., whereas low temperature gas should average 1000 B.t.u. In the one case we have 4000 cu. ft. @ 1000 B.t.u. plus 4000 cu. ft. of 400 B.t.u. In the other case we have 4000 cu. ft. of 1000 B.t.u. gas and the remainder in the coke residue. Inasmuch as 300 B.t.u. blue gas represents the richest gas that can be made as a dilutant from coke, this 4000 cu. ft. of 400 B.t.u. gas must represent a distinct gain. It can be shown this way:

4000 cu. ft. @ 1000+10,000 cu. ft. @ 300=14,000 @ 500 B.t.u.
8000 cu. ft. @ 700+8,000 cu. ft. @ 300 =16,000 @ 500 B.t.u.

Every time a high B.t.u. gas is broken down into two volumes of low B.t.u. gas and free carbon, the less of 300 B.t.u. blue gas can be used to obtain a determined B.t.u. This same reasoning applies to producer gas or any other substitute or combination.

Conclusions

A tremendous amount of work has been expended in the past by our fraternity, we feel, in trying to get rid of

the labor connected with the products of degradation of hydrocarbons. Its work has been too largely with secondary problems, and the fact that degradation and its cost in raw materials have taken place, have not caused enough concern. Had the presence of these troublesome products not caused labor costs to appear on the balance sheet, much less study along these lines would have ensued. One has only to stop to review the direction of the study given to stoppages from naphthalene and degraded tar to realize that much of this study could profitably have been put on the primary consideration of avoiding their formation.

In sketchily treating this angle of the physical aspects of coal carbonization, no attempt has been made to record any close measurements nor to balance the component parts with the original coal. Rather have we tried to put in some semblance of logical form certain laws, the understanding of which in their relationship to each other might be useful in determining how gas coal should be retorted to produce the most economical total of saleable constituents.

OPERATORS' SECTION

A. C. KLEIN, *Chairman*

Boston, Mass.

GENERAL DATA

	Size						Coal Scales				Coal Sampling			Coke Weights				Gas Metering			Heating Value		
No.	Retorts Per Bench	Benches	Total Retorts	Length	Width In.	Height In.	Location	Kind	Testing Frequency	Testing Method	Sampling Point	Frequency	Wt. of Sample Lb.	As Produced or Sold	Moisture Determined	Breeze Weighed	Producer Fuel Weighed	Kind of Meter	Frequency of Test	Gas Volume Corrections	Tests Per Day	Snap or Composite	Remarks
HORIZONTAL STOP END RETORTS																							
1	6	30	180	10′-0″	28	16																	
	6	20	120	9″-4″	26	15	Ret. house	Platform	—	—	Cars	½ mo.	4	Sold	Yes	No	No	Rot.	—	T	3	S	
2	9	24	216	9′-0″	26	16	—	Track	4 mo.	Test car	Cars	Car	50	—	No	No	No	Wet	Year	T-P	24	—	
3	6	14	84	10′-1″	28	16	Elevator	—	3 mo.	Wts.	Cars	1 mo.	—	Sold	Yes	No	Yes	Wet	3 mos.	T	1	S	
4	6	10	60	9′-3″	26	16	Ret. house	Platform	Week	Comparison	—	—	—	Sold	No	No	No	Rot.	—	T	1	—	
5	6	9	54	9′-0″	26	18	Bench	—	Year	City	—	—	—	Sold	No	No	Yes	Wet	Year	T	3	C	
6	6	9	54	9′-6″	28	18	Ret. house	Platform	Month	Wts.	Cars	Week	2	Sold	No	No	No	Wet	Year	T	2	S	
7	6	9	54	9′-3″	28	16	Ret. house	Platform	Month	Comparison	—	—	—	Sold	No	No	Yes	Wet	6 mos.	T-P	5	S	
8	6	8	48	9′-1″	26	15	Ret. house	Platform	Year	Wts.	—	—	—	Sold	No	No	No	Wet	Year	T	2	S	
9	6	8	48	9′-0″	26	16	Ret. house	Platform	3 mos.	Wts.	—	—	—	—	—	—	—	Wet	Year	T-P	—	S	
10	6	8	48	9′-0″	26	15	Ret. house	Platform	6 mos.	Wts.	Cars	2 weeks	50	Sold	Yes	No	Yes	Wet	Year	T-P	3	S	
11	6	7	42	9′-6″	28	16	Ret. house	Platform	2 mos.	Wts.	Cars	Month	500	Sold	No	No	No	Wet	Year	T	2	S	
12	6	7	42	9′-4″	26	16	Bench	Platform	Year	Wts.	Cars	6 mos.	150	Sold	No	No	No	Wet	2 years	T-P	1	S	
13	6	7	42	9′-6″	28	16	Ret. house	Platform	2 mos.	Wts.	Cars	Month	500	Sold	No	No	No	Wet	Year	T	2	S	
14	6	6	36	9′-3″	26	9	Ret. house	Platform	Year	Wts.	—	—	—	Sold	No	No	No	Wet	Year	T-P	1	S	
15	6	6	36	9′-0″	26	16	Ret. house	Platform	—	—	—	—	—	Sold	No	No	No	Wet	—	—	3 wks.	C	
16	6	4																					
	9	1	33	9′-0″	26	15	Dock	Wagon	—	City	—	—	—	Sold	No	No	No	Wet	Year	T-P	2	—	
17	6	5	30	9′-4″	26	15	Ret. house	—	Month	Car	—	—	—	Sold	No	No	No	Dry	5 years	T-P	1	C	
18	6	4	24	10′-0″	26	16	Ret. house	Platform	Year	Wts.	Cars	Month	100	Sold	No	No	No	Wet	Year	T-P	5	S	
19	6	4	24	9′-0″	26	15	Ret. house	Platform	Year	Wts.	Cars	Week	75	Sold	No	No	No	Orifice	—	T-P	2	S	
20	6	4	24		12	12	Ret. house	Platform	—	—	—	—	—	Sold	No	No	No	Wet	—	—	3 wks.	—	
21	—	5	23	9′-0″	22	16	Ret. house	Platform	Year	Wts.	—	—	—	Prod.	No	No	Yes	Wet	6 mos.	T-P	1	S	
22	—	3	21	9′-3″	26	9	Coal shed	Platform	Year	Wts.	—	—	—	Sold	No	No	No	Wet	Year	T-P	1	S	
23	6	3	18	9′-6″	28	16	Bench	Platform	2 mos.	Wts.	Cars	Month	500	Sold	No	No	No	Wet	Year	T	2	S	
24	6	3	18	9′-6″	26	16	Bench	Platform	6 mos.	Wts.	—	—	—	Prod.	No	No	Yes	Wet	2 mos.	T-P	4 wks.	—	
25	6	3	18	9′-3″	28	16	Ret. house	Platform	Year	Wts.	—	—	—	Sold	No	No	No	Wet	—	T-P	3	—	
26	6	3	18	9′-3″	28	16	Ret. house	Platform	6 mos.	Comparison	Pile	—	2	Sold	No	No	No	Wet	Year	T	1	S	
27	6	3	18	9′-0″	26	16	Bench	Platform	6 mos.	Comparison	Pile	Year	500	Sold	Yes	Yes	Yes	Wet	3 mos.	T-P	2	C	
28	6	3	18	9′-0″	18	—	Ret. house	Platform	6 mos.	Wts.	—	—	—	Sold	No	No	No	Wet	6 mos.	T-P	2	C	
29	—	3	16	9′-0″	18	18	—	Platform	—	—	—	—	—	Sold	No	No	No	None	—	—	1	S	
30	—	—	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	None	—	—	—	—	
31	6	2	12	9′-6″	26	17	Ret. house	Platform	—	—	—	—	—	Sold	No	No	No	Wet	Year	T-P	3	S	
32	6	2	12	9′-3″	26	16	Coal shed	Platform	Month	Wts.	—	—	—	Sold	No	No	Yes	Wet	2 years	T-P	1	C	
33	6	2	12	9′-2″	26	16	Bench	Platform	Year	Wts.	—	—	—	Sold	No	No	No	Wet	Year	T-P	3	S	
34	4	3	12	9′-0″	24	13	Ret. house	Platform	6 mos.	Wts.	—	—	—	Sold	No	No	Yes	Wet	—	T-P	2	S	
35	6	1	6	9′-2″	26	16	—	—	—	—	—	—	—	Sold	No	No	No	Wet	—	—	0	—	
36	6	1	6	—	—	—	—	—	—	—	—	—	—	Sold	No	No	No	None	—	—	0	—	
37	9	1	9	9′-0″	28	16	Ret. house	Platform	Month	Wts.	Cars	Car	—	Sold	No	No	No	Wet	Year	T-P	—	S	
HORIZONTAL PUSHED THROUGH RETORTS																							
101	6	50	300	12′-0″	26	16	Hopper	Hopper	Month	Wts.	Conveyor	Daily	125	Sold	No	Yes	Yes	(1)	—	T-P	Continuous		(1) Electric and Displacement
	8	10		15′-0″																			
102	8	10	288	15′-0″	26	16	Hopper	Hopper	—	Wts.	Cars	Car	35	Sold	No	No	No	Wet	—	T-P	2	Both	
	16	8		16′-0″																			
103	8	20	160	20′-0″	26	16	—	—	—	—	Cars	Car	—	Sold	No	No	No	Wet	—	T-P	4	C	
104	16	10	160	14′-0″	26	16	Machine	Hopper	3 daily		Cars	Week	75	Sold	No	No	No	Elect.	6 mos.	T-P	3	C	
105	9	14	126	9′-9″	26	16	Ret. house	Hopper	4 mos.	Comparison	Crusher	Daily	200	Sold	No	No	No	Elect.	Year	T-P	2	C	
106	8	12	96	21′-9″	26	16	Ret. house	Platform	—	Wts.	Barges	Barge	600	—	No	No	Yes	Flow	—	T-P	24	S	

General Data—Continued

No.	Size						Coal Scales				Coal Sampling			Coke Weights				Gas Metering			Heating Value		Remarks
	Retorts Per Bench	Benches	Total Retorts	Length	Width In.	Height In.	Location	Kind	Testing Frequency	Testing Method	Sampling Point	Frequency	Wt. of Sample Lb.	As Produced or Sold	Moisture Determined	Breeze Weighed	Producer Fuel Weighed	Kind of Meter	Frequency of Test	Gas Volume Corrections	Tests Per Day	Snap or Composite	
HORIZONTAL PUSHED THROUGH RETORTS (CONT'D)																							
107	6	16	96	10'-0'	28	16	Machine	Hopper	Year	Wts.	Conveyor	Daily	50	Sold	Yes	Yes	Yes	Orifice	6 mos.	T-P	3	S	
108	8	8	64	16'-0"	26	16	Ret. house	Hopper	Month	Wts.	Conveyor	Week	100	Sold	No	No	Yes	Wet	Year	T-P	24	Both	
								Track	Year	Car													
109	6	6	36	11'-6"	28	16	Ret. house	Platform	Month	Wts.	—	—	—	—	Yes	No	No	Rot.	3 mos.	T	2	S	
110	6	1	6	11'-0"	26	15	Bins	Platform			—	—	—	—	No	No	No	Wet	—	T	0	—	
INTERMITTENT VERTICAL RETORTS																							
201	9	28	262	22'-5"	18	30	Larry	Hopper	—	Wts.	Conveyor	Daily	100	Both	Yes	Yes	Yes	(2)	—	T-P	6	C	(2) Wet—Rotary and Electric
202	9	7	63	17'-10"	18	30	Larry	Hopper	Month	Wts.	Conveyor	Barge	3,000	Sold	Yes	Yes	Yes	Wet	—	T-P	9	Both	
203	9	5	45	18'-0"	13	17	Larry	Hopper	2 mos.	Comparison	—	Car	30	Sold	No	No	No	Wet	Year	T-P	2	—	
204	6	2	12	22'-6"	14	26	Larry	Hopper	—	—	—	—	—	Sold	Yes	No	No	Wet	Year	T-P	1	S	
CONTINUOUS VERTICAL RETORTS																							
301	9	5		20'-0"	14	34	Conveyor	Weight-		Wts.													
	8	6	93	20'-10"	16	23		ometer	Daily	Wts.	Cars	—	150	Sold	Yes	Yes	Yes	Wet	6 mos.	T-P	24	C	
302	4	8	32	25'-0"	14	67	Ret. house	Merrick	—	Wts.	Barges	Barge	600	—	No	No	Yes	Wet	—	T-P	24	C	
303	8	4	32	16'-11"	18	46	Conveyor	Weight-	2 weeks	Comparison	Barges	Barge	8,000	Sold	Yes	Yes	Yes	Wet	2 years	T-P	12	S	
304	4	5	20	25'-3"	14	55	—	ometer	—	—	Cars	3 cars	20	Sold	No	No	No	(3)	Year	T-P	12	S	(3) Wet and Rotary
305	8	2	16	25'-0"	20	29	Ret. house	Platform	Year	Wts.	Cars	Car	75	Prod.	No	No	No	Wet	6 mos.	T-P	4	C	
INTERMITTENT INCLINED RETORTS																							
401	9	10	90	18'-1"	26	15	Larry	Hopper	6 mos.	Wts.	Barges	Barge	1,000	Sold	No	No	No	Wet	Year	T-P	2	C	
402	6	12	72	15'-0"	26	15	—	—	—	—	Cars	5 cars	—	Sold	No	No	No	Wet	—	T-P	1	S	
403	9	5	54	20'-0"	24	16	Benches	Platform	Month	Wts.	Cars	Car	75	—	No	No	No	Elect.	Month	T-P	2	C	
404	6	4	24	16'-10"	26	16	—	Platform	2 years	Wts.	Cars	Car	75	—	No	No	No	Wet	—	—	1	C	
COKE OVENS																							
501	50	2	140	30'-10"	17	11'-8"	Bins	Platform	—	Wts.	Conveyors	Daily	4,000	Sold	No	No	*	(3)	Month	T-P	24	S	(3) Electric and Flow
	40	1		36'-0"	17	9'-1"																	
502	40	1	140	37'-8"	18	8'-5"	Yard	Track	6 mos.	Car	Conveyors	Daily	30	Sold	Yes	No	*	(3)	Month	T-P	24	S	*Gas Fuel Used
	25	4		32'-5"	17	6'-4"																	
503	56	1	64	37'-0"	20	9'-10"	Bins	Platform	6 mos.	Wts.	Larry	Daily	185	Both	—	—	*	Wet	Year	T-P	24	Both	
	8	1																					
504	30	2	60	37'-9"	16	11'-9"	Yard	Track	6 mos.	Car	Conveyor	Hour	50	Both	Yes	Yes	*	Rot.	Month	T-P	24	S	(4) Wet—yearly
505	40	1	40	37'-0"	17	9'-10"	Yard	Track	Month	Wts.	Larry	Daily	75	Sold	Yes	Yes	*	(4)	(4)	T-P	24	S	Flow—monthly
GAS OVENS																							
601	3	11	33	12'-0"	12	6'0"	Ovens	Platform	3 mos.	Wts.	Conveyor	10 cars	2	Sold	Yes	No	Yes	(5)	Year	T-P	24	S	(5) Displacement
602	3	10	30	22'-0"	12	6'-0"	Ovens	Platform	Month	Wts.	Conveyor	10 cars	2	Sold	Yes	No	Yes	(5)	Year	T-P	24	S	
603	3	10	30	18'-6"	14	9'-2"	Ovens	Larry	—	Wts.	Cars	Car	125	Sold	Yes	Yes	Yes	(5)	—	T-P	12	S	(6) Wet—yearly
604	3	6	18	13'-6"	12	6'-0"	Ovens	Platform	Month	Wts.	Conveyor	—	100	Sold	Yes	Yes	Yes	(6)	(6)	T-P	Continuous		Electric—monthly
605	3	5	15	21'-3"	12	8'-9"	Ovens	Platform	3 mos.	Wts.	Conveyor	10 cars	2	Sold	Yes	No	Yes	(5)	Year	T-P	24	S	
INCLINED GAS OVENS																							
701	3	16	48	18'-6"	14	7'-0"	Ovens	Larry	3 mos.	Wts.	Conveyor	10 cars	2	Sold	Yes	No	Yes	(5)	3 mos.	T-P	24	S	
702	3	8	24	19'-6"	14	7'-0"	Ovens	Larry	Month	Wts.	Conveyor	Week	200	Sold	No	No	Yes	(5)	—	T-P	12	S	

OPERATING DATA SUMMARY

Plant	No. Mos.	Coal Carbonized Tons Wet	Coal Carbonized % Moist.	Coal Carbonized Tons Dry	Coal Per Retort Wet	Coal Per Retort Dry	Fuel	Fuel Lbs. or M Cu. Ft. Per Ton Coal	Yields B.t.u. in Gas Per Lb. Coal	Yields Lbs. Dry Coke Per Ton Coal	Yields Lbs. Dry Breeze Per Ton Coal	Yields Lbs. Dry Coke and Breeze Per Ton Coal	Yields Gallons Tar Per Ton Coal	Yields Lbs. NH_3 Per Ton	Yields Lbs. for Sale Per Ton Coke	Yields Lbs. for Sale Per Ton Breeze	Coal and Coke Analysis: Coal Carbonized V. M.	Coal Carbonized F. C.	Coal Carbonized Ash	Coal Carbonized S	Coal Carbonized B.t.u.	Coal Carbonized Moist.	Coke Produced V.M	Coke Produced F. C.	Coke Produced Ash	Coke Produced S.	Coke Produced Shatter Loss	Coke Produced B.t.u.	Coke Produced Moist.
HORIZONTAL STOP END RETORTS																													
2	12	157			.77		Ck.		3,092				12.0	3.45			36.9	56.7	6.4	1.5		2.6	2 8	86.7	10.5	1.1			
3	12	45	1.75	44.20	.951	.934	Ck.	305	2,989			1,322	12.8	3.4			34.92	57.64	6.0	1.07	13,500	1.34	3 6	86 9	8.14	.75			1.60
4	12	43	2.0		.933		Ck.			1,300		1,300	14.0	1.0	875		38.83	58.85	2.3	.60	14,931	2.0							
5	12	27.5			.933		Ck.	257	3,113	1,412		1,412	14.3	3.6	1,154														
9	12	34.8			.95		Ck.						11.0	.91						1.6									
11	12	16.8	2.0		.70		Ck.		3,190	1,327		1,327	12.2		1,003		37.01	55.03	6.76	1.31	13,600	1.20	3.0	87.65	9.35	.64			2.0
12	12	19	4.0				Ck.		2,969	1,381		1,381	13.0		—1,003—		36.65	58.49	3.01	.52	14,000	1.33	3.95	79.25	16.8	1.62			12.0
13	12	19.6	2.0		.78		Ck.		3,180	1,362		1,362	13.7	4.4	1,052		37.01	55.03	6.76	1 31	13,600	1.20	3.0	87.65	9.35	.64			2.0
14	12	26.6			.74		Ck.		2,973	1,084			12.0	2.5	763														
15	12	23.5		22.6	.8	.75	Cl.			1,125			12.0	5 8	561														
16	12			18.5			Cl. & Ck.			1,260			12.0	-	1,260														
17	12	16.8			.69		Ck.		3,129			1,300	11.5																
18	12	23			.96		Ck.		2,880	1,175			12.3	.96	522														
19	12	14			.60		Ck.		2,770	1,250			10.0		930		35.89	55.24	8.87	.66	13,622								
21	12	12			1.		Cl.			1,200		1,200	12.0		600														
22	12	9.5			.73		Ck.		2,887	1,168			12.2		701														
23	12	9.1	2.0		.76		Ck.		3,190	1,396		1,396	12.8		960		37.01	55.03	6.76	1.31	13,600	1.20	3.0	8'.65	9.35	.64			2.0
25	12	15.1			.73		Ck.		3,259	1,446			12.1		1,093														
27	12	11.4			.97		Ck.	400	2,880	1,125	175	1,300	10.0				35.54	55.95	5.97	.95	14,024	2.54							
28	12			9.4		.79	Ck.		3,266			1,333	11.5																
33	12			10.1		.85	Ck.		2,715			1,300	12.0																
34	12	5.4			.45		Cl.	501	2,630	1,145			5.3		526														
37	12	10.1			.92		Ck.			1,250			11.2	3 0	544		37 07	54.43	6.73	1.14		.57							.18
HORIZONTAL PUSHED THROUGH RETORTS																													
102	12	6	.96				Ck.		2,856	1,139			9.7		965		33.67	55.45	8.51	1.45		.92							
104	12	250.1	1.5	246.4	1.56	1.54	Ck.		2,945	1,066			11.3		872		37.21	53.00	8.12	1.67			4.22	82.78	11.80	1.20		11,997	
105	12	104.8	0.89	103.9	1.03	1.02	Ck.		3,254				12.6	5.18			36.73	55.12	8.15	1.17		.89	2.68	93.16	4.16	.78		13,500	
106	12	94.6	1.38		1.9		Ck.	287	3,092								34.23	57.41	8.36	1.04		1.38	4.99	82.83	12.18	.69			
107	12	71.7			.75		Ck.	353	2,719			1,330	9.8	4.4	977		38.5	45.9	13.3			2.3							
108	7	112.1		110.9	1.75	1.73	Ck.	301		1,262			10.3	5.58	961		36.38	58.43	4.15	.78	13,908	1.04	2.41	90.40	7.19	.64		13,580	5.76
109	12			29		1.4	Ck.						10.0	6	1,300														
110	12	3			.50		Cl.						10 0		705														
INTERMITTENT VERTICAL RETORTS																													
201	12	481	.27	480	2.04	2.03	Ck.	378	3,141	1,164	270	1,434	12.2	5.57	1,026	72	34.9	57.2	7.9	1.09		.27	2.9	85.2	11.9	.89		12,603	3.1
202	12	93.4	1.56	91.9	1.48	1.46	Ck.	343	2,767	1,247	93	1,340	10.2	4.54	839		34.07	56.02	8.09	1.12		1.56	3.6	85.3	10.8	.86			
203	12	65			1.5		Ck.		3,032	1,263			14.1	5.55	990		37.78	53.66	7.19	.92		1.37	3.4	83.0	13.1	.80		11,900	3
CONTINUOUS VERTICAL RETORTS																													
301	12	182			2.7		Ck.	618		1,400			11.9	2.6			37.63	54.02	8.35	1.71		.60	2.26	85.77	11.30	.54			.67
302	12	135.2			4.2		Ck.	367	3,141				12.4	4.6	717		34.23	57.41	8.36	1.04		1.38	4.99	82.83	12.18	.69			2.24
305	12	20			2.5		Ck.		3,475	1,100			14.2		360		29.99	55.61	14.73	1.96	12,995	1.15							.36
INTERMITTENT INCLINED RETORTS																													
401	6	18.1			.47		Ck.		2,918				11.1	4.1			35.83	57.53	6.64	1.42									
402	12						Cl.										31.61	61.88	6.51	.64	13,424	1.77							
403	12	88	5.06	84	2.	1.9	Ck.		2,948				12.0	3.2			33.85	55.78	9.10	1.24		5.06	4.12	82.16	13.44	1.02			.28
404	12	35			1.5		Ck.						13.2	1 5	592					1.38									
COKE OVENS																													
501	12	49	3.83	47	10.4	10.0	Gas	4.82M		1,277			8.3	5.7	1,361		29.29	62.71	8.0	.79		3.8	1.37	88.93	9.70	.76	27.4		3.27
503	6		3.93		10.4	9.98	Gas	6.68M	3,246	1,333			8.9	6.4	1,333		32.27	62.69	5.04	.56	14,400	3.91	.84	92.63	6.53	.46	66.6	13,326	1.46
504	6		8.0				Gas			1,260	155	1,415	8.4	4.9	1,260	155	32.60	60.77	6.63	.60									
505	12	5.6	4.72	534	14.0	13.3	Gas	3.98M	2,915	1,372	78	1,450	8.4	5.9	595		26.3	66.7	7.0			.47							
GAS OVENS																													
601	12	51.6			18.2		Ck.	319		1,206			1.1	4.3	919		35.96	56.81	7.51	.62	14,006	2.1							
602	12	94			16.2		Ck.	303		1,206			11.2	4.9	933		35.96	56.81	7.51	.62	14,006	2.1							
603	12	12.9			6.2		Cl. & Ck.	409	2,794	1,219	215	1,434	9.3	4.6	1,219	215													
605	12	91			21.1		Ck.	301		1,206		1,340	13.3	5.7	935		35.96	56.81	7.51	.62	14,006	2.1							
INCLINED OVENS																													
701	12	116			17.7		Ck.	400		1,206			8.7	3.7	846		35.96	56.8	7.5	.62	14,006	2.14							
702	12	50	4.0	48	3.45	3.31	Cl. & Ck	450		1,170			10.0	4.0	640		32.68	54.01	13.3	1.54									

REPORT OF THE OPERATORS' SECTION

A. C. Klein, *Chairman*, Boston, Mass.

The work outlined for the Operators' Section at the organization meeting included the following:

1. To keep in touch with and summarize the latest developments and operating results of various types of plants.

2. To educate operators of coal gas plants to compile their operating results on a standard basis so that their figures would be comparable.

3. To carry to a conclusion the work initiated by last year's section of preparing forms of standard data sheets which would give comparable results for all plants and would be designed to fit plants of all sizes.

4. To standardize upon the type and number of instruments which a carbonizing plant should have in order to give results which will be valuable to the industry at large and to their own operation.

5. To keep in close touch with and supervise the research work being conducted by Professor Demorest at Ohio State University on the relative value of run-of-mine and screened coal for carbonizing purposes.

Plant Operating Results

In order to obtain information regarding the operating results of various types of plants and at the same time to obtain knowledge of what individual plants were doing in the way of recording data, letters were sent to all the carbonizing plants in the country enclosing copies of the general data sheet and operating data sheet, as drawn up by last year's committee, with the request that they be filled out and returned. In all, 72 companies complied with the request and returned the data sheets filled out with the information requested.

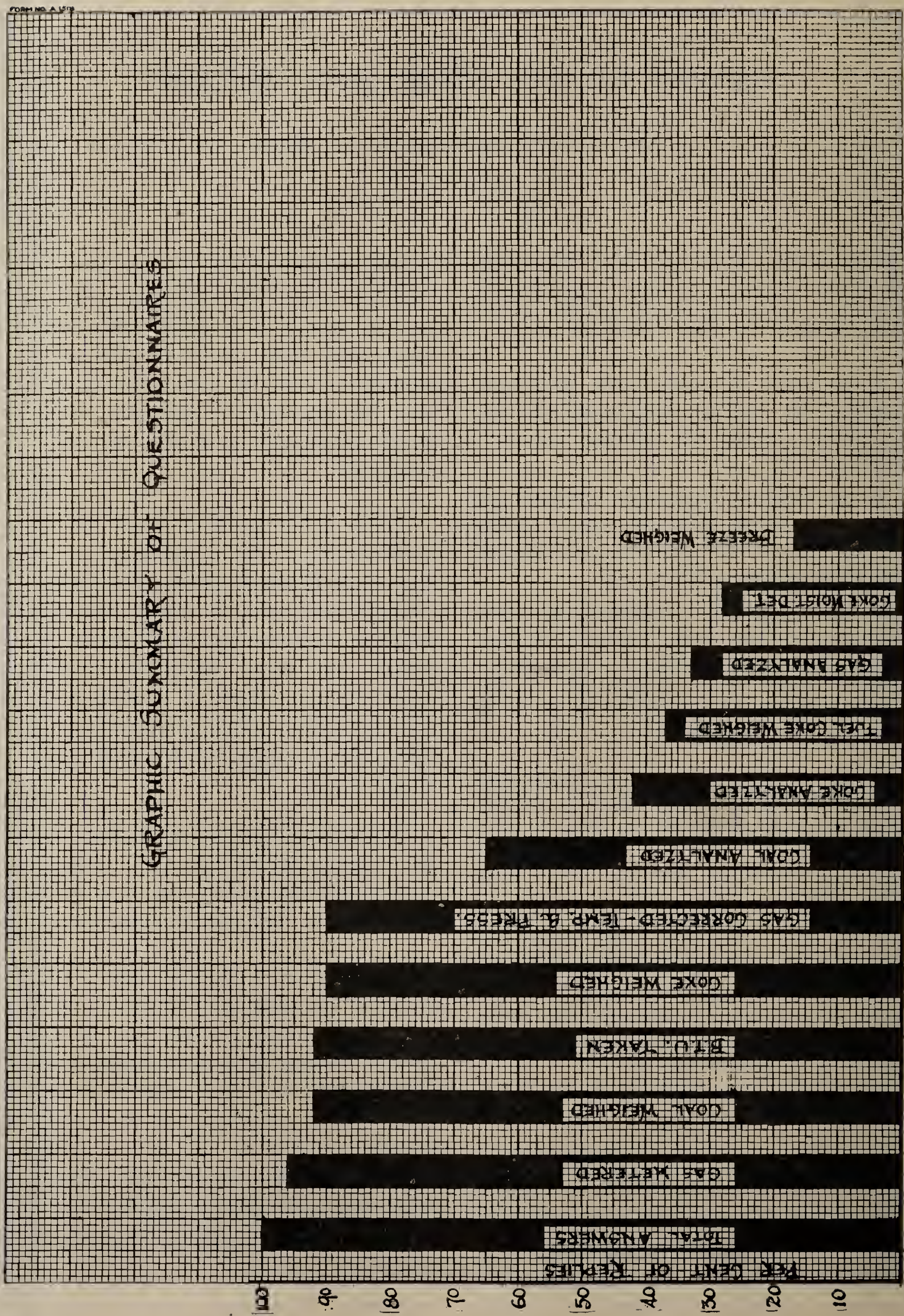
These answers have been carefully scrutinized by the committee in order to determine which plants were equipped with instruments and were following the practice outlined by last year's committee, and were, therefore, obtaining figures which could be compared with corresponding figures obtained by other plants of the same or different type of construction.

The committee is glad to report that the companies which have submitted operating data include most of the recent modern coal gas installations.

The tabulation between pages 16 and 17 gives the general data for all of the plants which replied and the operating data of those which were following the practice outlined last year and whose results were reported for at least six months.

The result of the answers received from the Committee's questionnaire is also shown graphically on the following chart.

Of the 72 answers which were received and tabulated, three companies


GRAPHIC SUMMARY OF QUESTIONNAIRES
PER CENT OF REPLIES
TOTAL ANSWERS
GAS METERED
COAL WEIGHED
B.T.U. TAKEN
COKE WEIGHED
GAS CORRECTED - TEMP. & PRESS.
COAL ANALYZED
COKE ANALYZED
FUEL COKE WEIGHED
GAS ANALYZED
COKE MOIST. DET.
BREEZE WEIGHED
100
90
80
70
60
50
40
30
20
10

reported that they had no meter by which to measure the quantity of gas made; six did not weigh the coal carbonized, and seven did not weigh the coke either as produced or as sold. Of the 69 companies which metered their gas, four made no correction for temperature and pressure variations and in all of the other important points of plant operation, on which the committee considers it desirable to record information, the number of companies failing to do so was considerably greater, as shown by the graphical summary.

On the back of the general data and operating data sheets drawn up by last year's committee, and which sheets represent the minimum information which the committee feels that each carbonizing plant should report, some explanation of the importance of keeping this data is given for each item. A study of the sheets returned by the companies has convinced the committee that some space in this report should be devoted to a brief statement of the reasons why coal gas plants would be benefited by compiling and recording the information recommended on these two sheets.

The statement that a gas company should meter the gas which it makes is obviously too self-evident to require comment. Not only is the company which fails to do so without any accurate information concerning its plant operations, but it has, in addition, no check on the conditions which exist in its distribution system. Leakage may mount to a prohibitive figure and the fact still escape notice unless the amount of gas which the plant makes and delivers into the mains is known.

Where a plant has only one meter of the flow type it should be regularly checked against a holder. While this method is not strictly accurate, it still gives a valuable check. Meters of the displacement type can easily be checked periodically by comparison with a small test meter connected in series.

There is no company, however small, which cannot well afford to install a platform scale so that coal can be weighed as charged into the retorts. A knowledge of the amount of coal carbonized is essential in order that the operating head can quickly realize the existence of unfavorable conditions which require his attention. It is only by correcting such unfavorable operating conditions that the cost of producing gas can be maintained at a minimum figure.

The amount of coke made should preferably be weighed before quenching. Where this is not possible, coke should be weighed immediately after quenching and a correction made for its moisture content. Where plant records are based upon the weight of coke as sold, its varying moisture content from day to day and from season to season may result in erroneous and erratic figures. In some small plants it may be difficult to weigh all of the coke as made. In such cases it is possible to make tests at periodic intervals to determine the percentage which the production of coke bears to the quantity of coal used. The committee recommends that this method be used only where it is impossible to weigh all coke as produced and that the tests be made at intervals of not over a month apart. At the time the tests are made it would be well to also analyze the coal and coke and to make a comparison of their ash content as a check.

Correcting gas for temperature and pressure variations requires only a

small amount of clerical labor. Where no temperature correction is made the plant results from day to day may appear to vary as much as from 4 to 5 per cent. In other words, the plant having an actual yield of 5 cubic feet per pound might, in the absence of temperature corrections, appear to be producing as much as 5¼ cubic feet per pound.

Failure to correct for barometer variations introduces less of an error than failure to correct for temperature, but it may produce material fluctuations in the apparent results from day to day.

Only 47 of the 72 companies reporting made any periodical analysis of the coal which they purchased. Over one-third of them were evidently without any knowledge of the variations which take place in the quality of their principal raw material. There are many reasons why gas companies should analyze the coal which they purchase. It is the only way that they can prove whether dealers are furnishing them with inferior fuel. It enables them to determine in advance what operating changes to make so as to obtain the best results from new grades of coal. It cannot fail to produce a beneficial moral effect upon the dealers who supply the coal and upon the operators who are responsible for efficient plant operation.

The committee very strongly recommends that all gas companies, no matter how small, arrange to sample every shipment of coal which they receive and to arrange for periodical coal analyses. If coal is being received from the same mine, monthly analyses will usually be sufficient. The cost of sampling and analyzing coal will not exceed a maximum of 5 cents per ton, which is cheap insurance for safeguarding the quality of coal and for maintaining efficient operation. A plant which consumes one car of coal per day or more can well afford to employ a chemist who can not only analyze coal but save his salary many times over by furnishing the plant superintendent with other operating information which will enable operating expenses to be reduced.

Eight of the gas companies replying to the questionnaire stated that they did not test the heating value of their gas. It is an acknowledged fact that the gas companies which give the best service to their consumers are those which deliver a uniform quality of gas from day to day. Fluctuations in heating value can only be prevented by taking frequent heating value readings. In addition, each B.t.u. delivered in excess of the requirements costs the company from ¼ to ½ cent per 1000 cubic feet. In large plants the installation of a recording calorimeter is recommended. For smaller plants there are several makes of calorimeter of a relatively inexpensive type which are available.

Only 25 companies, or less than 40 per cent of those using solid fuel, weighed the coke which is used in their producers. The committee realizes that in many small plants it is difficult to do so inasmuch as hot coke is drawn from the retorts and dropped directly into the producers. In such cases, the amount of coke used in the producers should be closely followed by making frequent tests (at least every 30 days) of 24 hours' duration, in which the producer fuel, coal charged, and lump coke and breeze made for sale should all be determined by weighing. The value of the producer fuel used is an

important part of the cost of gas and the amount used should be closely followed in order to keep it at a minimum.

The number of plants which analyze their coke, determine its moisture content and weigh breeze is less than 40 per cent of the total reporting. Coke is the most valuable coal gas residual and it is only by obtaining a maximum return from it that gas can be economically manufactured. In past years there has been considerable prejudice against the use of coke as a substitute for anthracite. This prejudice is being overcome by degrees and gas companies are now obtaining the domestic fuel markets to which they are entitled. It is, therefore, essential that our carbonizing plants pay especial attention to those operating methods which make for the production of high grade coke and for the production of the maximum quantity of it. This can only be done by having information of the quality and quantity of coke which is produced from day to day, and by promptly correcting the operating conditions which impair either.

The formation of breeze, in excessive amounts, is an element of waste in itself, as well as an indication of poor quality of the lump coke being made for sale. Breeze has a sale value of only about one-third of the coke from which it is produced, and consequently every ton represents a loss to the company of from $4.00 to $8.00.

In addition, its production in excessive amounts is an indication of soft or of brittle coke, both of which break in handling, producing excessive breeze at the plant, and also excessive breakage and breeze after delivery to customers.

By getting daily information of the quantity of breeze made the heats in the setting can be adjusted as and when required to maintain a maximum output of high grade lump coke, and a minimum of breeze.

The committee realizes that it is difficult for small plant operators to make complete gas analysis but it feels that regular determinations of CO_2 and oxygen are important. These constituents can easily be determined by means of a flue gas analysis apparatus of the absorption type using caustic potash for the absorption of CO_2 and a pyrogallic acid solution for the determination of oxygen. It is essential to have a knowledge of these constituents in order to make sure that the percentage of inerts in the gas does not reach prohibitive amounts.

The committee wishes to emphasize that its object in compiling these statistics is to be of help to the industry—both by presenting a survey of what companies are doing, and by pointing out ways in which plant operators can improve their results. To that end, it has been arranged that the replies which have been received will be kept on file at the Association headquarters. Members who desire further details regarding the operation of any particular plant in the list will, upon addressing inquiries to the Association headquarters, be placed in direct communication with the company in whose results they are interested, provided there is no objection from the latter.

Operating Code

As the work of the committee progressed it became evident that it would be advisable to expand the work included in Section 3 into a code which could

be used for the complete test of a carbonization plant. In this connection it was also considered advisable to incorporate the specification of testing and recording instruments in this code.

The committee has prepared and presents herewith a tentative outline of the proposed code for testing carbonizing plants. The real index of the performance of a carbonizing plant is in its heat balance and in its weight balance and the outline has therefore been drawn up with the idea that it can serve as the basis of a code which will specify the data and information necessary to compile both the heat and weight balances.

The outline suggested by the committee is given below. The outline applies to the simplest type of coal plant, viz.: one heated by coke burned in integral producers or by part of the gas generated.

The completed code should contain, in addition, test methods for outside producers, for blue gas equipment and for waste heat boilers, all of which must be considered as integral parts of the plants which contain them.

Carbonization Tests

1. General Considerations
   - (a) Length of test
   - (b) Starting conditions
     - I Preliminary observations
     - II Calibration of tanks, instruments and gauges
     - III Measurement and analysis of stocks in tanks.

2. General Observations
   - (a) Weather conditions
   - (b) Diary
   - (c) General temperatures and pressures.

3. Input
   - (a) Coal (daily composite sample)
     - I Kind
     - II Analyses, proximate, ultimate, gross B.t.u.
     - III Quantity
   - Breeze
     - I Weight
   - (b) Heating fuel
     - I Coke (daily composite sample)
       - a Analysis, proximate, B.t.u.
       - b Quantity
       - c Temperature
     - II Gas—kind
       - a Quantity
       - b B.t.u.
       - c Analysis
       - d Temperature
       - e Pressure
   - (c) Steam
     - I Quantity
     - II Temperature
     - III Pressure
   - (d) Air
     - I Quantity
     - II Temperature
     - III Moisture Content

4. Output
   - (a) Gas
     - I Quantity (hourly)
     - II Analysis (6 hrs. composite)
     - III Specific gravity (hourly)
     - IV Temperature (hourly) pressure
       - a At meter outlet
       - b At retort outlet
     - V B.t.u. (hourly composite)
   - (b) Coke
     - I Quantity—Moisture corrected
     - II Analysis, proximate, B.t.u. (daily)
     - III Screen test (daily)
     - IV Specific gravity (daily)
     - V Shatter test (daily)
     - VI Temperature
     - VII Quantity of breeze
   - (c) Tar
     - I Quantity—moisture corrected
     - II Analysis
       - a Carbon
       - b Water
       - c Distillation
       - d Ultimate analysis
       - e Acid content
       - f Naphthalene

(d) Ammonia
  I Liquor system
    a Quantity of liquor
    b Analysis of liquor
  II Direct process
    a Quantity of liquor
    b Analysis of liquor
    c Ammonia in gas

(e) Light oil and drip oil
  I Quantity
  II Analysis, B.t.u., ultimate, distillation
  III Specific gravity

(f) Sulphur
  I Hydrogen sulphide
  II Fixed sulphur

(g) Naphthalene
  I Quantity

(h) Waste gas
  I Quantity
  II Analysis—inlet and outlet recuperators
  III Specific gravity
  IV Temperature—inlet and outlet recuperators

Coal Carbonizing Tests

During the past year, the experiments started by last year's committee have been carried on to completion.

The data, results and conclusions are given in detail in Prof. Demorest's paper, which follows. These tests have shown that insofar as the yield and quality of gas and coke are concerned there is very little advantage in using screened coal instead of run-of-mine coal or slack except that the screened coal contains a smaller percentage of ash.

The coal used in the tests was received as run-of-mine coal and was screened at the experimental plant. The analyses of the slack, lump and run-of-mine coal obtained as a sample showed little difference in ash content. Probably in commercial operation the small difference in quantity and quality of gas and coke obtained from slack and lump coals might be somewhat greater than the figures shown by the experiments, inasmuch as commercial slack coal frequently contains a materially larger percentage of ash than screened coal. As Prof. Demorest brings out, there may also be other economic factors which would affect the choice of coal. These are largely a matter of local conditions that must be balanced against the increased cost of screened coal in each individual instance. The tests do show, however, that slack coal of similar analysis will give substantially the same number of heat units per pound in the form of gas, and that the quantity and quality of coke made from slack coal is not materially different than that made from lump coal.

There has also been contributed, as part of the report of the operators' section, a paper by Prof. D. W. Wilson, entitled "Mechanism of High Temperature in Coal Carbonization."

CARBONIZATION YIELDS FROM RUN OF MINE, SLACK AND +¾″ COALS

Prof. D. J. Demorest, Ohio State University, Columbus, Ohio.

Several years ago the writer, recognizing the rapidly growing importance of the gas industries and the necessity of training engineers in Gas Engineering, requested of the Engineering Experiment Station of The Ohio State University funds for installing a coal gas plant and by-product recovery system of sufficient size to give the seniors a chance to do thesis work in Gas Engineering and to carry out certain experiments on Ohio coals. The request resulted in a grant from the Legislature of $10,000 to which has been added from time to time grants and gifts from various sources. The equipment now consists of a full scale vertical U. G. I. retort with exhauster, scrubbing towers, meters, etc., sufficient to determine accurately the yields of gas, ammonia, light oils, tar and coke, and in addition a complete pneumatic cleaning table of the American Coal Cleaning Corporation.

The Carbonization Committee of the American Gas Association, knowing of this equipment, asked the Association for $3000 for the cost of experiments herein reported.

Description of Plant

The carbonization retort is a regular installation of the U. G. I. Contracting Company's vertical retort. The retort and its structure is built just outside of a rear wing of Lord Hall. The gas which is taken off of both top and bottom passes through a 4″ main which is water sealed in a tar well. The gas is drawn from the retort by means of a 3600 R. P. M. centrifugal exhauster arranged with a by-pass so that the suction on the retort can be kept practically at zero. Manometers attached to both top and bottom off-takes show the suction on the retort so that the operator can keep a close adjustment of the suction at all times. This high speed exhauster makes a very efficient tar remover so that very little tar is condensed out in the scrubbing towers. The scrubbing towers are made of lead 2′ x 8′ and are filled with wooden grids. Through the first two towers is continually circulated a dilute sulfuric acid solution which absorbs the ammonia, the acid returning to a launder from which a duriron pump re-circulates the liquor through the towers. The third tower has a current of cold water passing through to cool the gas to metering temperature. Following the third tower is a Smith recording gas calorimeter and a Bailey indicating integrating flow meter. Following these meters is a displacement station meter of the ordinary rotating type. A proportioning meter is mounted on the station meter and automatically takes out 1 cu. ft. out of 1500 and stores it in a bell type balanced

gas holder with a capacity of 12 cu. ft. This is the sample used for analysis.

A car capable of holding one ton of coke is used for catching the coke as it discharges from the retort and a Fairbanks scales is used for weighing the hot coke immediately after discharged. A tank about 20 ft. above ground holds sufficient water to completely quench the coke (as soon as it is weighed) by means of a spray with fifty orifices which is swung over the coke car as soon as weighing is completed.

Coals Used

It was originally intended to use at least a half dozen coals but owing to various exasperating delays and accidents it was only possible to finish work on three. The coals were shipped to the University siding in car load lots, direct from the mine. The tests required about 25 tons of each coal and the rest of the coal was purchased by the University for power purposes. The coals were diverted to the University by the following companies from their regular supply except that the coals for these tests were run of mine:

Providence Gas Co., Stonega Coal Co., No 3 Rhoda Mine.

Rockford Gas Light and Coke Co., Holly-Stover Coal Co., Benham, Ky.

Rochester Gas & Electric Corp., Pittsburgh Coal Co., Mine 164 (Montour).

Coal Preparation

From each car of coal was taken about 8 tons of coal to be used as run of mine sample and 15 tons which were screened to obtain the slack and plus ¾″ samples in sufficient amounts. The plus ¾″ and run of mine samples were then passed through a set of Jeffrey rolls set at ¾″ opening. From this on the three kinds of samples were treated exactly alike.

Carbonization

The following description of one run will do for all runs:

Two thousand fifty pounds of coal are carefully weighed and hoisted to the bin above the retort. The temperature in the top combustion chamber is taken, all products from the previous runs are carefully removed and fresh solution is put in the acid launder and seals and all meters set at zero. The retort top door is opened and the coal passed through a chute from the bin into the retort. While the coal is running into the retort samples are rapidly dipped out of the running stream, totaling approximately 50 pounds. As soon as the entire charge is in the retort the top door is tightly closed, the exhauster started, circulating pump started and then one operator constantly watches the exhauster to keep suction on the retort as nearly as possible 1/20″ of water. The sample is weighed and taken to the laboratory for analysis.

As soon as it is obvious that the run is proceeding regularly 1/20 of the total amount of gas is by-passed after passing the station meter through the light oil scrubber. As a check on the recovery of light oils in the scrubber a regular light oil determination train is operated during the entire run. (The results of the scrubber were practically the same as those obtained by the light oil train. The only advantage of the scrubber is that sufficient light oil is obtained to get distillation results.)

Once every hour a titration for H_2S in the gas is made.

The Smith recording calorimeter and the Bailey indicating meter are frequently inspected to see if the curves of B.t.u. per cu. ft. and gas per hour as shown on these meters are normal. If these curves are erratic it indicates a stoppage somewhere in the system. During the run of about 8 hours the two operators are kept busy with the sulfur determinations, testing the acid solution to make sure that it is sufficiently acid, regulating the rate of gas passing through the light oil scrubber to 1/20 of the rate indicated by the Bailey meter, recording the station meter, temperatures and pressures and barometric pressure and keeping the mains open. All angles in the gas main are fitted with crosses so that it is possible to clean out quickly any part of the system that becomes stopped with soot during the run. Each coal has a temperature at which its gas becomes easily cracked and if that temperature happens to be exceeded much trouble results from soot catching the tar and interfering with the passage of the gas. If this happens it is quickly shown by the way the manometers and meters act.

While the operators are carrying on the test two workmen are preparing, weighing and hoisting the coal for the next run.

The end of the run is always pretty sharply foretold by a rather abrupt drop in the B.t.u. curve of the Smith calorimeter and the rate curve of the Bailey meter. The exact end of the run has been arbitrarily taken as the point where the gas has dropped to a B.t.u. value of 300 per cu. ft. and the rate to 500 cu. ft. per hour.

The rate of gas-making at the start of run is about 3500 cu. ft. per hour with a B.t.u. value of about 650 per cu. ft.

When the end of the run has arrived the operator quickly stops the circulating pump and exhauster, closes the valves in the gas main (pressure immediately begins to be built up in the retort), climbs to the top of the retort and opens a small valve in the bridge pipe.

The runs were usually finished about 7:00 p. m. In the morning the ammonium sulfate liquor is weighed and sampled, the tar weighed and sampled, the coke discharged and immediately weighed hot, quenched, screened and sampled and all the pipes cleaned (tar in these pipes and mains is weighed with the tar in tar well) and all equipment put in order for the next run.

The station meter reading is recorded, the light oil gas sample reading is recorded, the absorbant oil (benzolized) is weighed and sampled, the Bailey meter and Smith calorimeter meter charts removed and filed. The gas sample taken by the proportioning meter is analyzed for CO_2, C_2H_4, O_2, CO, H_2, CH_4, C_2H_6, N_2, CS_2 and B.t.u. The B.t.u. determinations are made in duplicate.

The equipment is now ready for the next run.

The coal, coke, tar, ammonia, liquor and absorbent oil are analyzed by the laboratory whenever it may be convenient.

It was impossible to have the retort at the same temperature day after day since the natural gas which was used for heating fluctuates very widely in pressure. As a result a good many runs were rejected, either because the temperature fell abnormally low or else was so high that the gas was seriously

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The equipment is now ready for the next run.

The coal, coke, tar, ammonia, liquor and absorbent oil are analyzed by the laboratory whenever it may be convenient.

It was impossible to have the retort at the same temperature day after day since the natural gas which was used for heating fluctuates very widely in pressure. As a result a good many runs were rejected, either because the temperature fell abnormally low or else was so high that the gas was seriously

CARBONIZATION YIELDS ON RUN OF MINE AND SIZED COALS

TEST NO.	2	3	4	5	6	7	9	10	11	12	13	14
Coal	Holley	Ston.	Ston.	Ston.	Ston.	Ston.	Ston.	Holley	Holley	Holley	Holley	Holley
Carbonizing Time	7–50	8–0	7–20	9–0	8–30	7–20	8–15	9–50	8–30	7–10	7–10	8–30
Size	1"on.5"	R.M.	R.M.	R.M.	+¾"	+¾"	+¾"	—¾"	—¾"	+¾"	+¾"	+¾"
Retort Temp. Beginning	1921	1967	2010	1909	1872	1978	1933	1820	1909	2000	2055	1885
Retort Temp. End	1881	1897	1945	1897	1750			1764	1820	1909	1945	1750
*Gas Per Ton	10500	10500	11000	10500	10500	10890	10950	10900	10960	11230	11180	10580
*Gas Per Lb.	5.250	5.250	5.500	5.250	5.250	5.445	5.475	5.450	5.480	5.615	5.590	5.290
*B.t.u. Per Cu. Ft.	545	533	520	553	547	580	530	510	520	535	523	548
**B.t.u. Per Ton	5722	5600	5720	5806	5744	6316	5803	5557	5694	6008	5847	5798
B.t.u. Per Lb.	2861	2800	2860	2903	2872	3158	2902	2779	2847	3004	2924	2899
GAS ANALYSIS												
CO_2	1.2	1.7	1.6	1.75	1.50	1.30	1.90	2.30	2.10	2.30	1.40	1.40
C_2H_4	3.2	3.0	3.4	3.10	3.50	3.50	3.20	3.50	2.40	4.00	3.70	4.00
O_2	0.5	0.5	0.4	0.5	0.4	0.4	0.8	0.6	0.5	0.4	1.5	1.6
CO	8.8	8.8	7.9	8.00	8.10	7.80	7.4	8.9	8.8	7.6	8.2	7.6
H_2	46.0	48.9	52.50	45.00	48.90	52.90	49.50	45.30	49.00	49.00	54.00	41.90
CH_4	27.0	25.0	22.80	29.30	25.2	25.4	25.2	25.60	24.60	26.60	25.50	31.00
C_2H_6	2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
N_2	11.3	10.1	10.4	10.4	18.40	6.60	8.00	12.8	9.6	9.1	9.0	11.5
S in H_2S												
***S in CS_2			11.0	11.0	11.0		10.0	10.0	8.0	9.0	8.0	9.0
COKE												
Weight	1340	1442		1427	1400	1423	1422	1400	1415	1393	1405	1460
% Over ½"	12.5								95.83	96.60	96.60	96.30
% Under ½"									4.17	3.40	3.40	3.70
SHATTER TEST												
On 2"	25	26		30	38	38	33	30	33	28	30	43
2" on 1"	49	52		47	48	48	53	43	45	52	50	40
Thru 1"	26	20		23	14	14	14	27	22	20	19	17
COKE ANALYSIS												
Moisture	0.10	0.11		0.12	0.09	0.09	0.09	0.2	0.12	0.03	0.14	0.11
Ash	5.39	5.14		6.48	4.34	4.75	4.1	5.64	5.08	3.65	5.00	4.83
Volatile	2.42	1.33			2.18			2.29		2.23		
Sulphur	0.50	0.55		0.59	0.54	0.54	0.53	0.48	0.47	0.43	0.43	0.42
Tar Lbs.	116		111	8.0	105	89	117	76	113	130	128	129
Light Oils Lbs.	15	26	15	18	15.5	12.0	18.5	15.5	11	12.5	21.5	22.5
Lbs. NH_3 Per Ton												
COAL ANALYSIS												
Air Dry	3.05	0.35				0.15		1.36			0.13	
Moisture	1.33	0.83				0.89		1.15			1.17	
Volatile	38.02	35.73				36.01		36.86			38.70	
Fix. Carb.	58.57	60.51				60.81		59.02			57.52	
Ash	2.08	2.95				2.38		2.97			2.61	
Carbon	81.83	81.77										
Hydrogen	5.49	5.12										
Oxygen	9.91	8.22										
Nitrogen	1.16	1.24				1.24						
Sulphur	0.53	0.70				0.66		0.57			0.57	
B.t.us.		14666										

TEST NO.	35	36	37	38	39	40	41	42	44	45
Coal	Holley S	Holley S	Holley S	Holley S	Holley S	Holley S	Holley S	Holley S	Holley S	Holley S
Carbonizing Time	9–45	8–10	8–0	7–35	8–15	8–15	12–30	10–40	9–10	8–45
Size	—¾"	—¾"	R.M.	R.M.	R.M.	R.M.	—¾"	—¾"	+¾"	+¾"
Retort Temp. Beginning	1792	1872	1945	1945	1989	1921	1764	1967	1885	1846
Retort Temp. End	1764	1885	1833	1897	1872	1820	1764	1978	1778	1833
*Gas Per Ton	12010	12050	11750	11730	12200	11900	12550	12050	11600	11450
*Gas Per Lb.	6.005	6.025	5.875	5.865	6.100	5.950	6.275	6.025	5.800	5.725
*B.t.u. Per Cu. Ft.	481	481	513	527	512	525	515	520	542	546
**B.t.u. Per Ton	5770	5800	6080	6180	6250	6250	6450	6270	6300	6250
B.t.u. Per Lb.	2885	2900	3040	3090	3125	3125	3225	3155	3150	3125
GAS ANALYSIS										
CO_2	2.5	2.2	2.5	2.4	2.6	1.7	2.2	2.2	2.5	2.4
C_2H_4	2.9	2.8	3.1	3.1	3.2	3.2	2.4	1.9	3.6	4.1
O_2	1.0	0.8	0.8	0.8	0.6	0.6	1.2	0.9	0.5	0.3
CO	8.6	7.9	8.3	9.0	6.9	9.0	8.7	8.4	7.9	8.2
H_2	46.8	49.6	45.5	47.7	47.6	48.8	42.0	49.6	47.6	46.4
CH_4	24.4	24.1	26.3	22.9	23.9	24.6	27.1	24.0	24.8	24.0
C_2H_6	1.4	1.0	1.0	2.5	1.8	2.1	1.6	1.0	2.0	2.1
N_2	12.0	11.4	12.3	11.4	13.3	10.0	14.3	11.0	10.3	12.8
S in H_2S										
***S in CS_2	8.4	8.0	8.4	7.0	7.2	8.8	7.4	7.0	7.4	8.8
COKE										
Weight	12.94	1270	1240	1320	1295	1310	1315	1315	1315	1310
% Over ½"	96.2	97.3	96.6	97.0	97.2	97.4	97.7	97 6	97.1	97.2
% Under ½"	3.8	2.7	3.4	3.0	2.8	2.6	2.1	2 4	2.9	2.8
SHATTER TEST										
On 2"	31.5	36.0	37	34		42	44	43	27	35
2" on 1"	45.5	43.5	46	48		40	38	40	50	46
Thru 1"	23	20.5	17	16		18	18	17	23	19
COKE ANALYSIS										
Moisture	0.13	0.9	0.23	0.22	0.14	0.15	0.18	0.17	0.11	0.06
Ash	7.73	8.51	7.89	7.66	6.33	6.16	7.98	6.66	4.88	5.22
Volatile	0.98						1.17			0.77
Sulphur	0.49	0.40	0.46	0.45	0.45	0.48	0.42	0.45	0.45	0.45
Tar Lbs.	90.	88.0	104	104	103	109	88	95	92	113
Light Oils Lbs.	16.5	12.5	14.5	13.5	15.5	15.0	12.0	11.5		
Lbs. NH_3 Per Ton										
COAL ANALYSIS										
Air Dry	0.49	0.49								
Moisture	1.98		1.61				1.80		1.65	
Volatile	36.04		37.72				36.90		38.40	
Fix. Carb.	58.14		58.01				58.28		57.20	
Ash	3.84		2.66				3.02		2.75	
Carbon	80.47									
Hydrogen	5.29									
Oxygen	8.59									
Nitrogen	1.33									
Sulphur	0.48		0.52				0.50		0.53	
B.t.us.	14262									

TEST NO.	33	16	19	21	22	23	24	26	27	29	30	31	32
Coal	Pitts.	Pitts.	Pitts.	Pitts.	Pitts.	Pitts.	Pitts.	Pitts.	Pitts.	Pitts.	Pitts.	Pitts.	Pitts.
Carbonizing Time		9–0	9–50	10–10	8–10	9–50	8–20	9–45	9–25	9–20	8–15	9–35	8–0
Size	—¾"	—¾"	—¾"	—¾"	R.M.	R.M.	R.M.	R.M.	+¾"	+¾"	+¾"	+¾"	+¾"
Retort Temp. Beginning	1792	1885	1778	1630	1778	1897	1820	1909	1833	1598	1833	1675	1820
Retort Temp. End	1764	1820	1778	1595	1859	1764	1750	1778	1675	1690	1675	1627	1820
*Gas Per Ton	10500	11700	10540	9450	10925	10600	10850	11175	10750	10920	10975	10275	10900
*Gas Per Lb.	5.250	5.850	5.270	4.725	5.462	5.300	5.425	5.587	5.375	5.460	5.488	5.138	5.450
*B.t.u. Per Cu. Ft.	500	475	505	560	500	502	535	519	510	528	521	526	517
**B.t.u. Per Ton	5250	5550	5320	5300	5460	5321	5800	5800	5500	5715	5222	5400	5630
B.t.u. Per Lb.	2625	2775	2660	2650	2730	2660	2900	2900	2750	2858	2861	2700	2815
GAS ANALYSIS													
CO_2		1.50	1.60	1.8	1.6		1.5	1.5	2.0	1.8	1.5	2.1	1.8
C_2H_4		2.40	2.0	3.5	2.7		3.9	3.5	2.6	3.5	2.7	3.9	3.0
O_2		0.7	0.5	0.5			0.6	0.5	0.4	0.4	0.3	0.86	0.5
CO		9.1	9.3	8.5	8.0		8.0	8.1	7.5	7.1	7.9	8.2	8.5
H_2		45.0	48.5	49.8			43.0	44.0	48.5	47.3	54.0	46.4	51.0
CH_4		31.0	28.6	29.4			30.4	29.0	26.9	25.2	24.6	26.2	26.0
C_2H_6		1.0	1.0	1.0			2.0	2.0	0.4	2.3	1.4	1.0	0.6
N_2		9.3	8.5	5.5			10.6	11.5	11.7	12.4	10.5	11.4	8.2
S in H_2S													
***S in CS_2		9.0	11.0	13.0	19.0		15.0	18.0	14.0	12.0	14.8	15.6	13.8
COKE													
Weight	1345	1460	1480	1420	1380	1380	1359	1300	1248	1350	1280	1350	1375
% Over ½"		96.4	95.5	94.5	97.0	96.8	96.0	96.5	96.1	97.4	97.1	96.6	96.7
% Under ½"		3.6	4.5	5.5	3.0	3.2	4.0	3.5	3.9	2.6	2.9	3.4	3.3
SHATTER TEST													
On 2"	35	15	15	18.5	16.0	18	16	17	21	19	24	23	25
2" on 1"	38	23.5	23.5	21.0	24.0	23	24	24	19.5	23	19	19.5	17
Thru 1"	27	11	10.5	8.5	9.0	9	10	9	8.5	8	7	7.5	8
COKE ANALYSIS													
Moisture	0.11	0.05	0.14		0.11	0.04	0.08	0.16	0.00	0.00	0.00	0.00	0.07
Ash	17.60	15.90	15.8		12.60	11.76	10.67	12.32	11.22	12.73	10.78	11.43	11.65
Volatile			2.47							1.65			
Sulphur	1.00	0.87	0.97		0.89	0.8	0.81	0.85	0.83	0.8	0.74	0.75	0.77
Tar Lbs.	107	97	86	72	100	113	126	90	101	104	106	132	120
Light Oils Lbs.	11.5	15.6			17.0		14.0	14	10	17		12	11
Lbs. NH_3 Per Ton													
COAL ANALYSIS													
Air Dry		0.0											
Moisture		0.24			0.3				0.39				
Volatile		34.54			34.79				35.28				
Fix. Carb.		57.25			57.69				56.43				
Ash		7.97			7.22				7.9				
Carbon					78.20								
Hydrogen					5.16								
Oxygen					6.97								
Nitrogen					1.51								
Sulphur		1.10			0.94				0.91				
B.t.us.					13834								

Ave.	Ave.	Ave.	Ave.	Ave.	Ave.	Ave.	Ave.	TEST NO.
Ston.	Ston.	Holley S	Holley S	Holley S	Pitts.	Pitts.	Pitts.	Coal
8–3	8–1	8–0	8–13	10–25	9–0	8–55	9–35	Carbonizing Time
R.M.	+¾"	R.M.	+¾"	—¾"	R.M.	+¾"	—¾"	Size
1962	1928	1950	1934	1854	1851	1752	1771	Retort
1913	1750	1856	1843	1829	1788	1697	1739	Temp.
10667	10780	11895	11208	11753	10888	10765	10600	Gas Per Ton
5.333	5.390	5.948	5.604	5.877	5.444	5.382	5.281	Gas Per Lb.
535	552	519	539	505	514	520	510	B.t.u. Per Cu. Ft.
5709	5954	6190	6041	5924	5595	5493	5510	B.t.u. Per Ton
2854	2977	3095	3020	2962	2798	2798	2755	B.t.u. Per Lb.
								GAS ANALYSIS
1.7	1.6	2.3	2.1	2.2	1.5	1.8	1.6	CO_2
3.4	3.4	3.2	3.8	2.7	3.4	3.2	2.5	C_2H_2
0.4	0.5	0.7	0.5	0.8	0.5	0.5	0.6	O_2
8.1	7.8	8.3	8.0	8.6	8.0	7.8	8.6	CO
48.8	50.4	47.4	47.8	48.1	43.5	49.40	45.8	H_2
25.6	26.2	24.4	26.4	25.1	29.7	25.8	28.0	CH_4
2.0	2.0	1.9	1.4	1.3	2.0	1.2	1.0	C_2H_6
10.3	8.1	11.8	10.0	11.2	11.4	10.2	11.5	N_2
310	290	227	222	256	485	418	420	S in H_2S
11	10.5	8.0	8.3	7.2	17	14	11	S in CS_2
								COKE
1435	1415	1292	1336	1335	1355	1321	1326	Weight
		97.1	96.76	96.93	96.58	96.78	95.47	% Over ½"
		3.0	3.24	3.03	3.43	3.22	4.53	% Under ½"
								SHATTER TEST
28	36	38	33	36	34	45	33	On 2"
50	50	45	47	43	48	39	44	2" on 1"
22	14	17	20	21	18	16	23	Thru 1"
								COKE ANALYSIS
0.12	0.09	0.19	0.09	0.15	0.1	0.02	0.1	Moisture
5.81	4.4	7.01	4.72	6.94	11.84	11.56	16.43	Ash
1.33	2.18		1.5	1.46		1.65	2.47	Volatile
0.57	0.54	0.46	0.43	0.47	0.84	0.78	0.95	Sulphur
100	104	105	118	90	107	113	91	Tar Lbs.
20	15.3	14.6	18.8	13.2	15.0	13.0	15.6	Light Oils Lbs.
5.2	4.9	5.6	5.1	5.0	5.0	5.0		Lbs. NH_3 Per Ton
								COAL ANALYSIS
0.35	0.15		0.13	0.93			0.00	Air Dry
0.83	0.89	1.61	1.41	1.48	0.3	0.39	0.24	Moisture
35.73	36.01	37.72	38.55	36.88	34.79	35.28	34.54	Volatile
60.51	60.81	58.01	57.36	58.65	57.69	56.43	57.25	Fix. Carb.
2.95	2.38	2.66	2.68	3.00	7.22	7.90	7.97	Ash
81.77		79.83		80.47	78.20			Carbon
5.12		5.49		5.29	5.16			Hydrogen
								Oxygen
1.24	1.24	1.16		1.33	1.51			Nitrogen
0.76	0.66	0.52	0.55	0.52	0.94	0.91	1.10	Sulphur
14666				14624	13834			B.t.us.

*Measured at 60°F, 30" of mercury and saturated with water. **B.t.u. per ton in Ms. of B.t.u. ***Given in grains of sulphur per 100 cu. ft

"cracked." We had hoped to have at least four acceptable runs on each kind of coal which would have made a total of thirty-six runs but we actually made about fifty. The temperatures tabulated were taken by optical pyrometer at the top combustion chamber but this does not mean much concerning the average retort temperature. The carbonizing times give a better indication of relative temperatures.

It would have been very desirable to run continually in three shifts, but the funds available were insufficient to do this and laboratory space would not have been sufficient to take care of all the testing. It was found advisable to operate only one shift, making the carbonization run on one day and cleaning up the products, weighing and testing them the next day. It must be kept in mind that it is necessary in these tests to clean up all pipes and mains after each run so that the products can be accurately weighed. The volatile left in the coke is, of course, abnormally low owing to this procedure.

Results

All results for gas volumes and B.t.u. values were figured to standard engineering conditions, 60°F., 30 inches mercury pressure and saturated with water. Sulfur values in the gas are given in grains per 100 cu. ft.

The funds and time available were not sufficient for analysis of all the tars but enough were analyzed to show that the water content averages about 26%.

On the basis of the amount of gas made and the total B.t.u. in the gas per ton of coal, the results indicate that screened coal is very little, if any, better than run of mine coal or even slack coal (if fresh). The figures for total B.t.u. per ton average exactly the same for run of mine as for plus ¾″ coal, while those for the slack coal are very little lower.

The coke made per ton of coal is practically the same for run of mine, plus ¾″ and slack. The screening tests show no notable difference in the quality of the cokes from these three sizes. The shatter tests, likewise, indicate no advantage of the plus ¾″ coal over the other sizes.

As far as yields, therefore, from these three coals are concerned it does not seem to be worth the extra cost to buy the sized coal (plus ¾″).

It is possible that the slack coal would tend more to heat on long storage and undergo more deterioration, but if the coal is not to be stored a great length of time, this would be unlikely to be of much effect on coals of the type used in the gas industry.

If high ash coals were used, there would be more likelihood of the slack coals being decidedly higher in ash than the other sizes and therefore the coke made from such slack might be so high in ash as to greatly injure the sale of the coke. This is not true of the low ash coals used in these tests which are typical of the coals used in the gas industry.

Screen Tests on Coals as Used.

Sample	Holly-Stover Coal	Pittsburgh Coal	Stonega Coal
Plus ¾″ Crushed			
On ½	48	42	42
" 5/16	23½	24½	26
" 3/16	10½	13	14
" ⅛	6	3	7
Thru ⅛	11	17½	10
Slack (– ¾″)			
On ½	18	43	56
" 5/16	20	21½	14
" 3/16	25	14½	13
" ⅛	12½	9½	7
Thru ⅛	22	11	9
R of M Crushed (– ¾″)			
On ½	38¾	36	40
" 5/16	30¾	24½	27
" 3/16	14	18	17
" ⅛	6¼	7	7
Thru ⅛	8½	13	9

MECHANISM OF HIGH TEMPERATURE COAL CARBONIZATION

PROFESSOR D. W. WILSON*

INTRODUCTION

THE USE of ovens of various widths for the carbonization of coal leads naturally to the question as to what is the most economical width. Many considerations must be borne in mind in deciding this, such as construction costs, kind of coal, maintenance, operating, as well as the additional tonnage gained by the narrower oven. One vital question is the definite determination of the relationship between the width of oven and the coking time—all other things being kept equal. A search of the literature failed to reveal any quantitative treatment of this, consequently these experiments were designed with a view toward studying the mechanism by which coke is formed commercially from coal in the by-product oven. The tests described in this paper were performed at various times upon different ovens in a block of sixty Semet Solvay Regenerator ovens placed in operation on September 15, 1920.

The ovens have a height of 10′ 9½″ to coal line, an average width of 18½″, tapering from 17½ to 19½, and a length of 35.5′. The brick in the heating walls are silica, and have a thickness of 4″. The coal was a mixture of Pennsylvania coals, high and low volatile, being so proportioned as to obtain about 27% volatile in the mixed coals. When charged into the ovens, the coal contained 4% free moisture, and as regards size was 70% through an 8 mesh screen. The oven charge was fifteen net tons of wet coal. When these experiments were made, the actual coking time was 17.0 hours and the hottest flue temperatures were from 2500 to 2550° F.

Experimental Methods

It was planned to follow that rate of formation of coke from the oven wall to the center by placing in one horizontal plane between these two points several pipes from each of which simultaneous readings could be made, first, of pressures, second, of temperatures, third, of the composition of gas. It was necessary on one given run to take pressures only, on another, temperatures, and on another, gas analyses. However, it seemed quite certain that the coal used and oven operation were sufficiently uniform from day to day so that results obtained in this manner could be compared without serious error. As indicated in Fig. 1, holes were drilled through the door frame and its brick lining so as to give, from the outside to the center either four or, in some of the tests, five sampling holes. The distances between pipes varied from test to test and the exact figures given in

*Director, Buffalo Station, Massachusetts Institute of Technology, School of Chemical Engineering Practice, Cambridge, Mass. This paper is the contribution of Prof. Wilson to the Carbonization Committee program and the statements therein are to be credited to the author and not considered as the conclusions of the Committee.

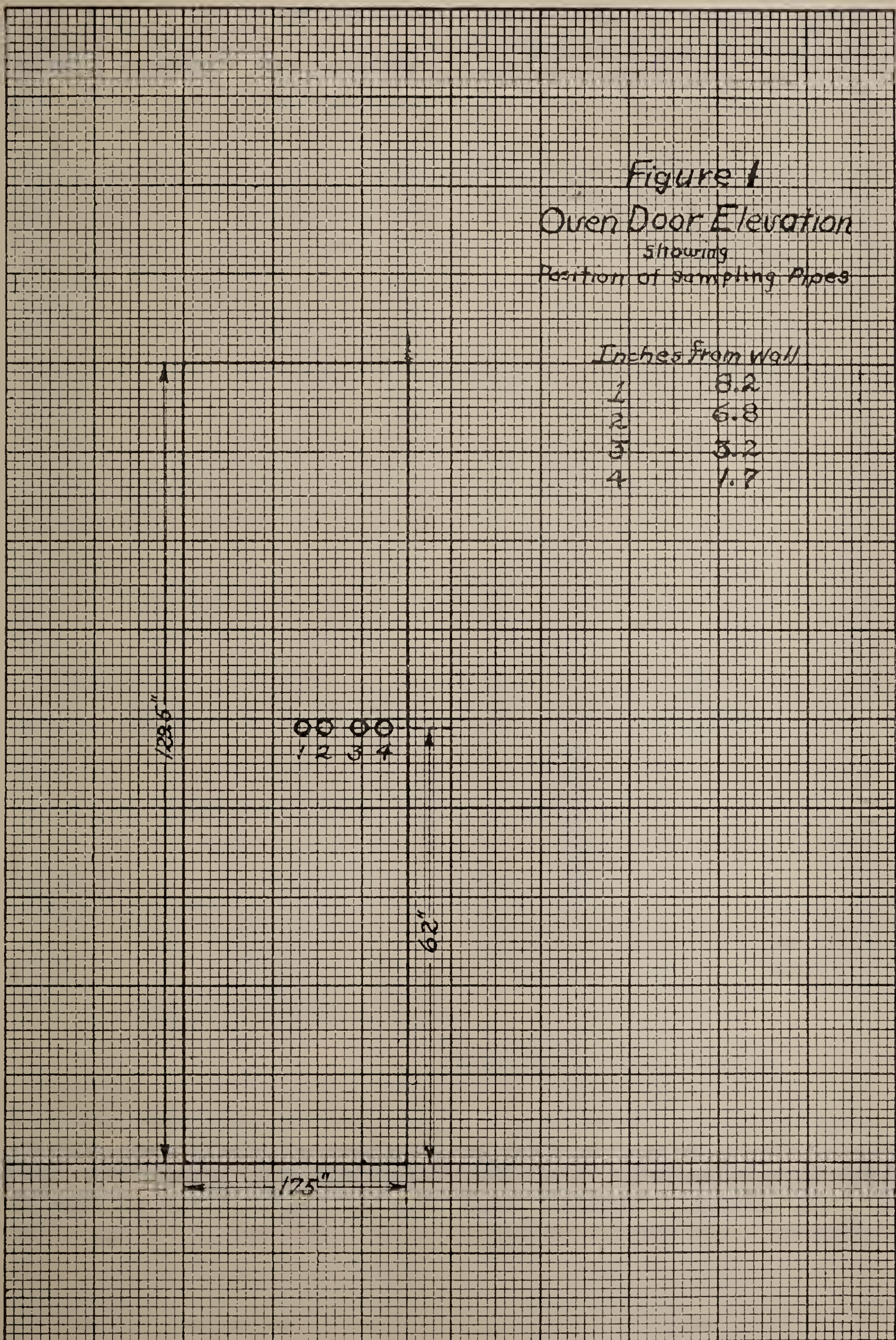
Figure I
Oven Door Elevation
Showing
Position of Sampling Pipes
Inches from Wall
1 8.2
2 6.8
3 3.2
4 1.7
128.6"
1 2 3 4
62"
175"

Fig. 1 apply only to the temperature run, values for which are shown in Fig. 3. The end of the pipe in the coal was 3½′ from the inside of the brick door lining, and approximately 5′ from the bottom of the oven. Sampling pipes used were standard ¾″, having an open inside end for taking pressures and gas analyses, and a closed end for the temperature measurement.

In case of the pressures, the inside ends of each pipe were swedged down to give an opening of about ¼″. This was done so as to narrow down the width over which the individual pressure measurements were taken. In a similar manner, it was attempted to locate definitely the points of gas sampling. For taking the pressures, an ordinary "U" tube, filled with water, was used. In taking pressures great precautions were found necessary to ram out the ends of the pipe with a small steel rod in order to keep them free of tarry materials which would quickly clog them at the time when the coal became plastic. In order that the manometer should not get clogged with tar and thus render readings difficult, a trap and a small filter were inserted in the sampling line between the outside end of the pressure pipe and the manometer proper.

For the temperature measurements, Chromel Alumel thermocouples were used. These were connected by compensating leads through a six-point switch to a millivolt meter. Great difficulty was encountered in taking good gas samples. This will be discussed more fully later, but in general the results of gas analyses are included here only as highly qualitative evidence in favor of conclusions which we have drawn from pressure and temperature measurements.

Difficulty was encountered in knowing exactly where the inside ends of the pipes were located. When it is considered that one-half the width of the oven is only about 8¾″, it will be realized that the difference of .2 or .3 inches in the location of the sampling points within the coal represents a serious error. To take care of this, through the door lining about a 12″ piece of 1¼″ pipe was placed to serve as a sleeve and guide for the ¾″ pipes which fitted it snugly. On the other hand, there was some play even with this scheme and, in addition, a very slight difference in setting the door in place after pushing an oven would move the inside ends of the pipes considerably one way or the other from the wall. It was impossible to detect this with our methods until the pressure or temperature measurements at certain times indicated it. However, it is felt that the pipe positions and their distances from each other are known to about ¼ of an inch. In brief then, the experimental method consisted in placing, through these holes so that the inside end was about 3½′ from the brick lining, either four or five sampling pipes spaced about as shown in Fig. 1—to start observations with the charging of the oven and to continue until just before the oven was pushed.

Experimental Data

Fig. 2 shows the results obtained in three separate pressure runs. Wherever dotted lines are indicated, this represents our opinion of the pressures, but that no observations were taken there. The pipes were numbered from 1, which was on the inside, to 5, on the extreme outside. It will be well to notice that the two outside pipes within the first

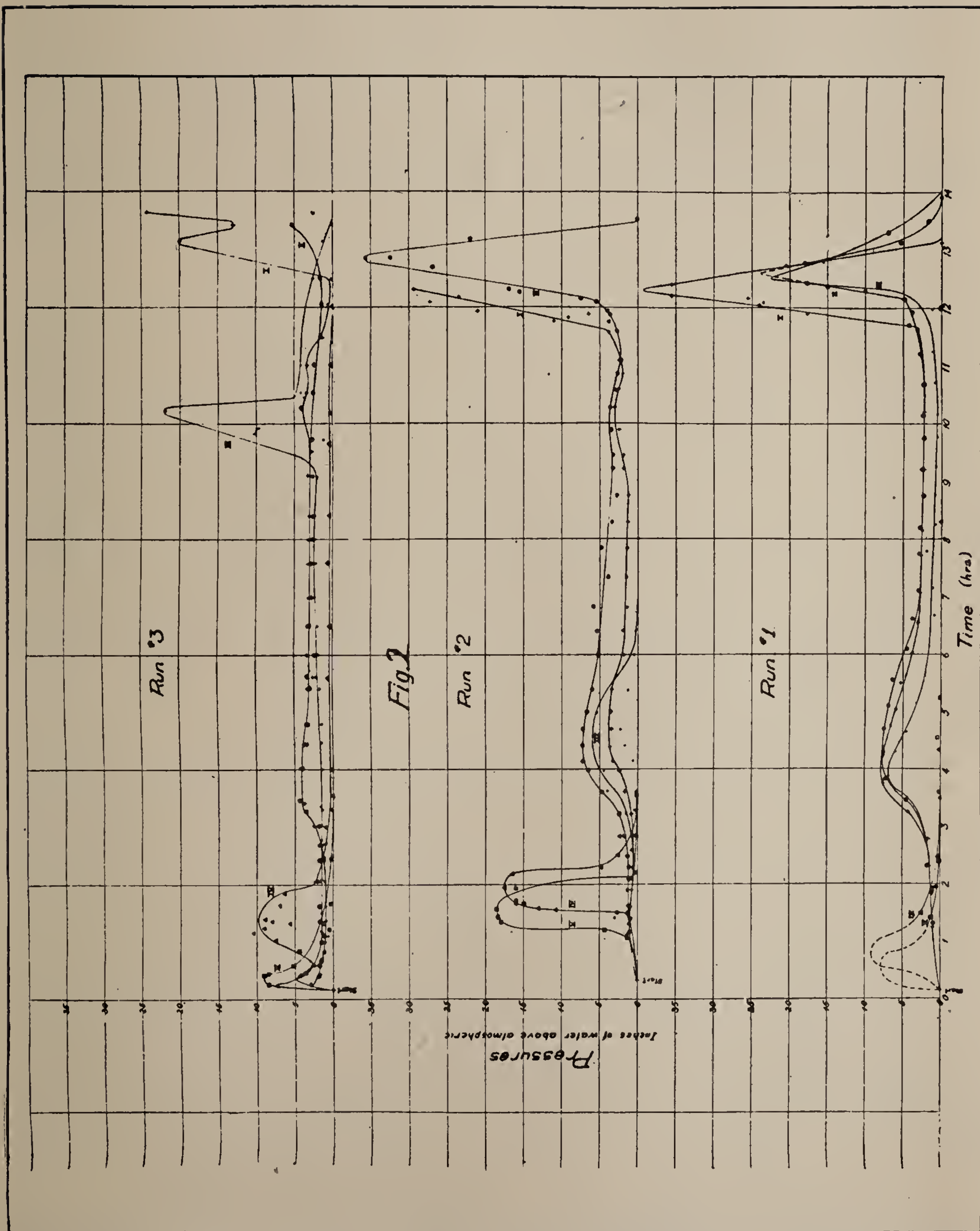
Run #3
Run #2
Run #1
Time (hrs)
Pressures
Inches of water above atmospheric

Fig. 2

two hours show a period of extremely high pressure and subsequent decrease to practically zero while the three inside pipes show fairly high uniform pressures for several hours after charging. Our idea of the period of extremely high pressure, which is substantiated by the difficulty of keeping the inside end of the pipe clear, is that at this time the coal has formed at that point a plastic sticky mass. After this high pressure has passed, the structure of the coke is completely formed and there is little resistance to the passage of gas; also, it is to be noticed that about twelve hours after charging this plastic zone has reached the center of the oven.

Fig. 3 shows the results of one temperature run which virtually is the average of three independent runs. While this will be discussed considerably more in detail later, it should be noted that during the first hour a temperature of about 900° F. is attained even at the very center of the oven. This subsequently drops off to about the boiling point of water where it seems to remain for possibly six hours, thereafter increasing at a rapidly increasing rate as the temperature goes up. On this run, the thermocouples were removed from the coke when 2000° F. was obtained since they did not last well above that temperature, and that at that point coking is virtually complete. It should not be assumed, however, that the coke was pushed at this time. Other measurements indicate that the pushing temperature of the coke was about 2300° F.

Fig. 3A shows the variation in percentage of hydrogen and hydrocarbons of the methane series at various times in samples taken only from points very near the middle of the oven. As would be expected, before the fusion zone has reached the middle, the methane is high and hydrogen low, while the reverse is true after the fusion zone is at the center. In these runs, unfortunately no samples were taken between about the seventh and thirteenth hours so that we have no record as to the quality of the gas between these points. On the curves we have drawn in straight lines connecting the points. Undoubtedly, this does not represent what happens in the oven.

Results

From practical experience it is known and also our temperature curves indicate that the zone of fused coal progresses inward rapidly at first and later goes on at a much slower rate. Due to this knowledge, it seemed reasonable to suppose that the distance of the fusion zone from the oven wall would be related to the time after charging in the form of some power function. In order to test this, we have assumed the following equation:

$$y^x = k\,\theta \qquad \text{(I)}$$

where y is the distance, expressed in inches, of the fusion zone from the oven wall at the time θ in hours after charging, and x and k are presumably constants. Referring again to Fig. 2 and using in each of these runs the determined positions of the pipes, and considering that the fusion zone occurred at the time of maximum pressure, in the above equation we have substituted values for y and θ for each of the pipes in each of the three runs. It should be noted here that, in figuring the distance of any pipe from the oven wall, we have arbitrarily deducted from its nominal distance ½ inch, considering that this thickness of deposited carbon exists practically as a part of the heating wall. By solving, simultaneously, thirty pairs of equations so obtained, the resultant average value of x is 1.834. Substitution of this value gives an average value of k of 2.87. As an illustration of the method of calculation used, the following example may be given:

Run No. 1, pipe No. 2 $\quad 6.4^x = 12.4\ k \quad$ (A)

Run No. 3, pipe No. 4 $\quad 1.86^x = 1.25\ k \quad$ (B)

By taking logarithm of both sides of both equations—

$$x\ (.807) = \log k + 1.094 \qquad \text{(A)}$$
$$x\ (.270) = \log k + .097 \qquad \text{(B)}$$
$$.537\ x = .997$$
$$x = 1.86 \text{ and } k = 2.55$$

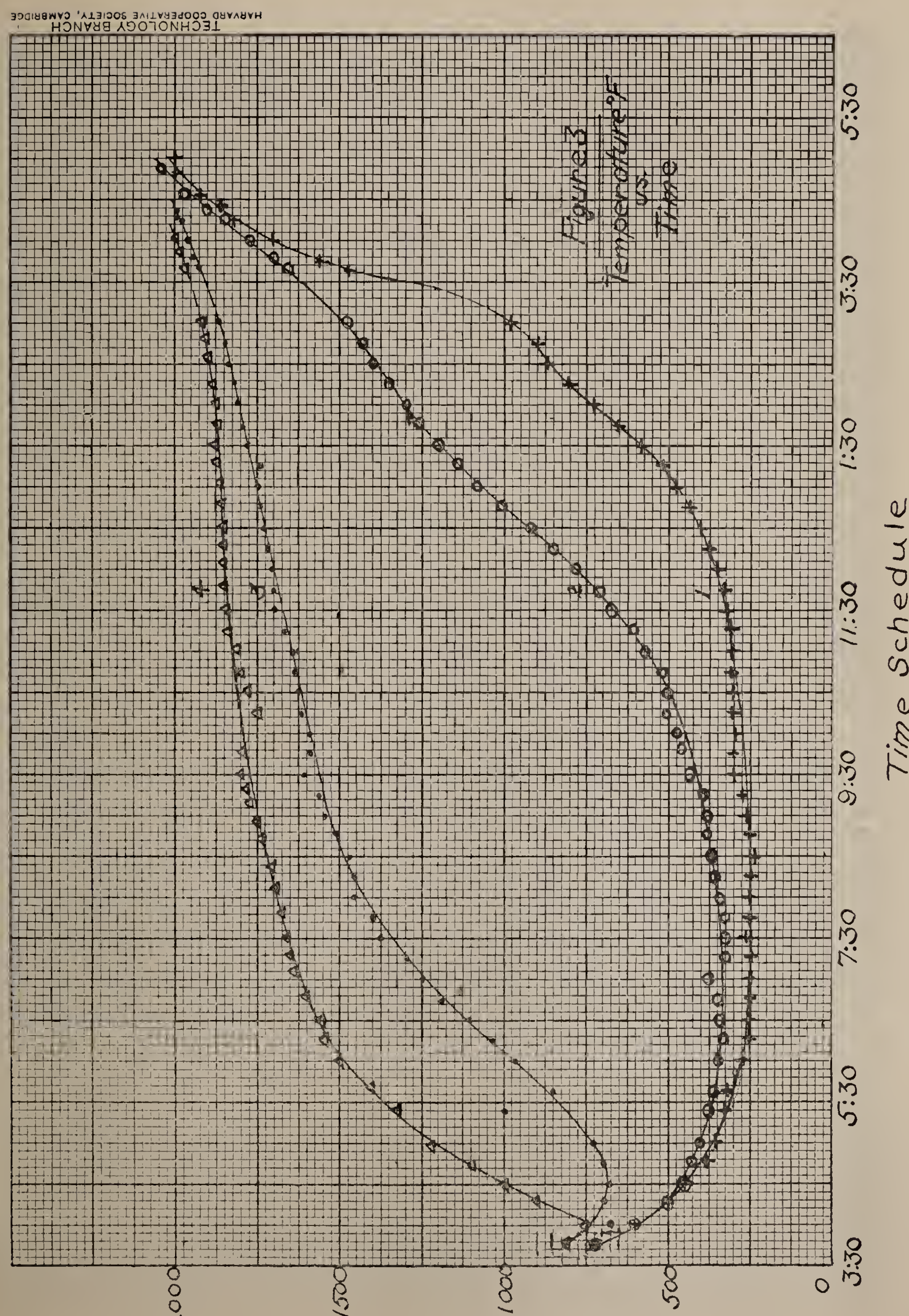
Figure 3
Temperature °F vs. Time
Time Schedule
Temperature °F
3:30
5:30
7:30
9:30
11:30
1:30
3:30
5:30
0
500
1000
1500
2000
1
2
3
4
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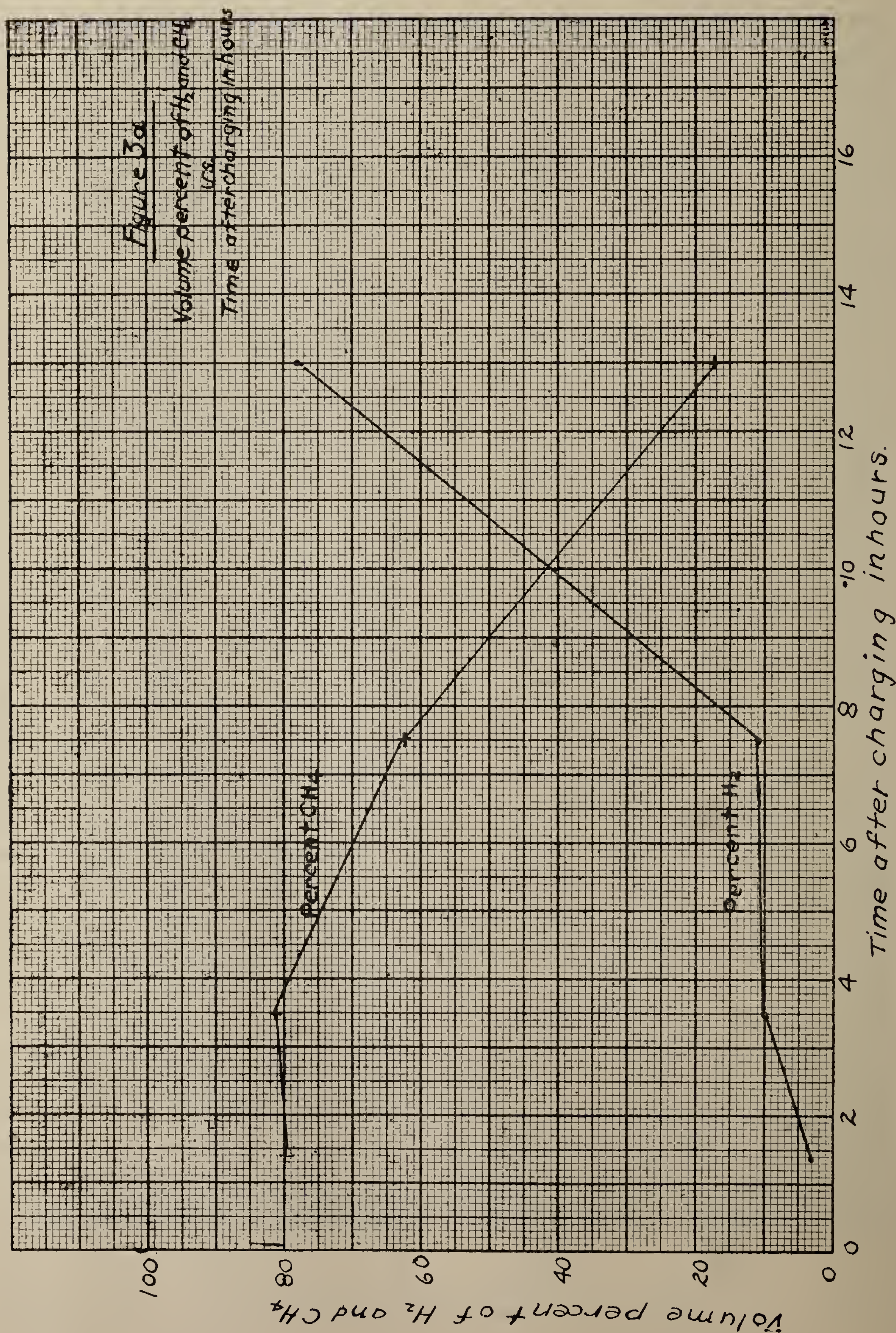


Figure 3a
Volume percent of H2 and CH4
vs.
Time after charging in hours
Percent CH4
Percent H2
0
2
4
6
8
10
12
14
16
Time after charging in hours.
0
20
40
60
80
100
Volume percent of H2 and CH4

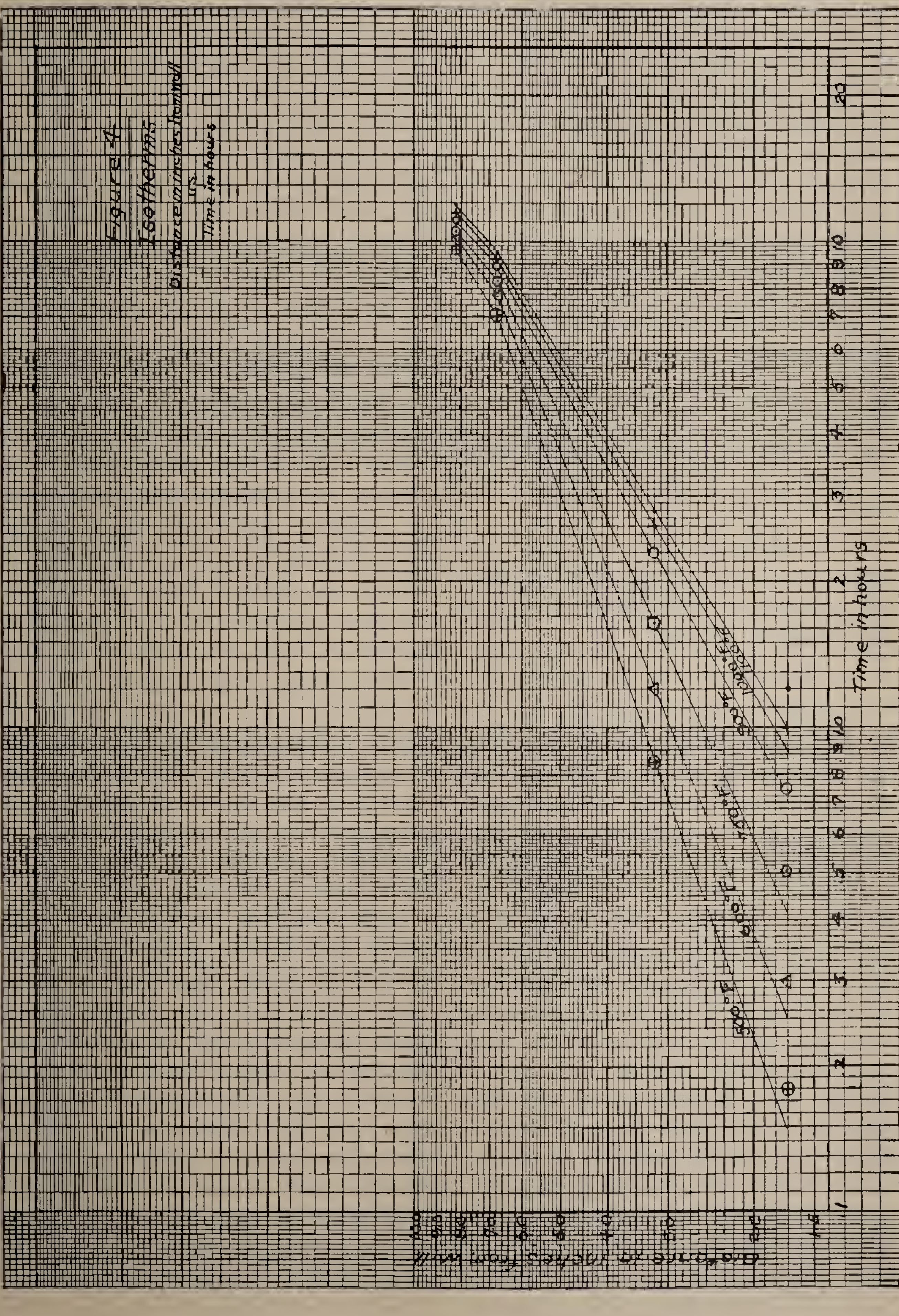


Figure 4
Isotherms
Distance in inches from wall
vs.
Time in hours
500°F
600°F
700°F
800°F
900°F
1000°F
Time in hours
Distance in inches from wall

Inasmuch as, in these pressure runs, we had some doubt as to the exact position of the inside ends of the pipes, by the use of the average value of k and x as given above, we have calculated back by substitution in equation (I) to determine the exact positions of each of the pipes in each of the runs. Going one step further in this, using these corrected pipe positions, we have now recalculated average values of x and k giving, respectively, 1.76 and 2.54. In all these calculations values, so far from the average as to render them obviously untrue, have been omitted from the later calculations. In other words, using our original estimates on the pipe positions, the following equation was obtained:

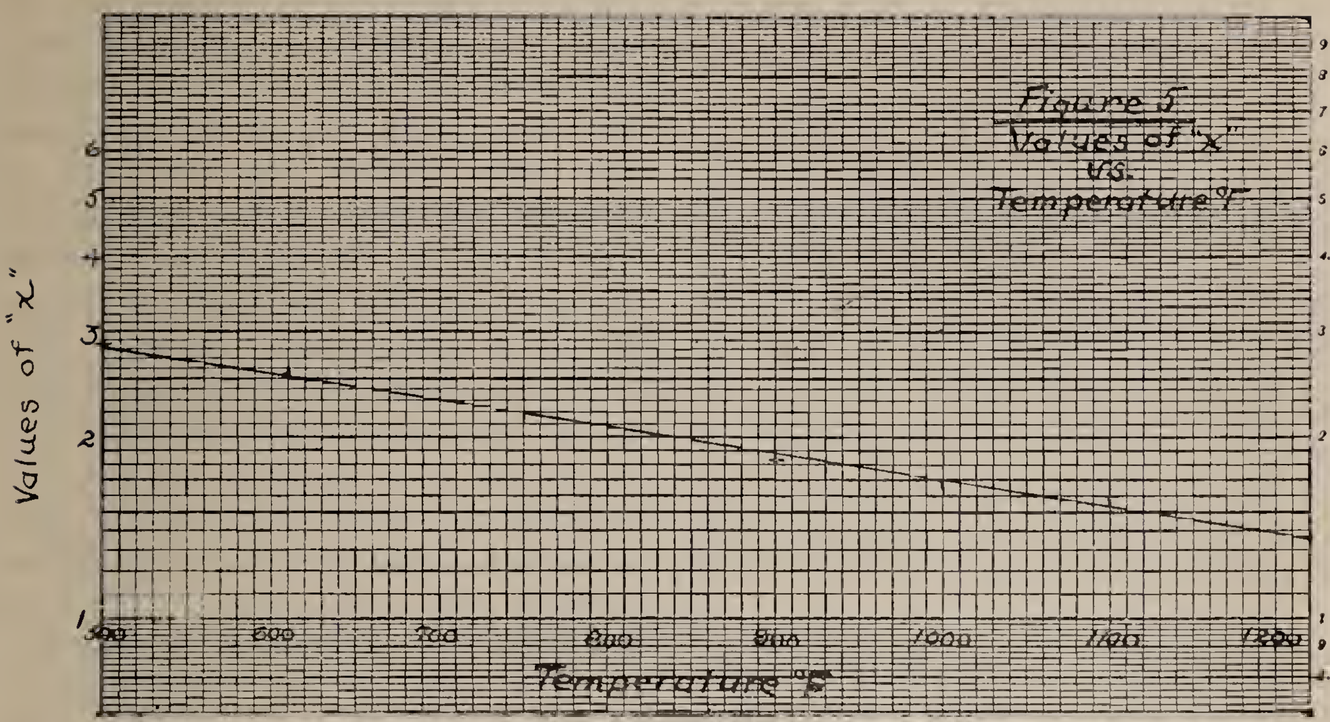
$$y^{1.834} = 2.87 \ \theta$$

while corrections of the pipe positions and subsequent recalculation results in the following equation

$$y^{1.76} = 2.54 \ \theta \qquad \text{(II)}$$

Equation II then represents, as well as we have been able to determine it, the relationship existing between the distance from the wall of the fusion zone and the corresponding time after charging. It is desired here to call attention to the fact that, in this equation, the pipe positions were not as well known as could be desired since these were our first attempts, and later experience resulted in better precision. Also that, due to clogging of the pipes with the plastic coal at the time of fusion, some uncertainty always must exist as to the exact time at which a given pipe was subjected to the fusion zone. Despite this, however, the equation is thought to be reasonably quantitative and reference will be made to it later when similar equations, derived from the temperature curves, are considered.

Looking now to the temperature, as shown in Fig. 3, it seemed wise to make a series of plots, one of which would show how the temperature of 500 deg. moved from the wall toward the middle of the oven; another would show how 600° travelled; still another possibly 750°, and so on, up to the highest temperatures which seem significant. In other words, we drew a series of isotherms for the movement from the wall to the middle, of the following temperatures, arbitrarily chosen; 500° F., 600°, 750°, 900°, 1000° and 1100° F. Since there were four pipes, in this series of tests, in the space from the wall to the center, we had four points on each isotherm. From the shape of these curves, on ordinary coordinate paper, it was seen that, again, a power function connected the distance from the wall and the time, consequently, in Fig. 4, these isotherms have been plotted on logarithmic paper. Inspection of these lines shows them to be substantially straight up to a distance of 1½ inch from the center of the oven. The points represented by pipe No. 4 located, presumably, 1.7″ from the wall uniformly fall below the straight line drawn through the points representing pipes 2 and 3. Further, it will be observed that, if pipe No. 4 were 1.9″ from the wall instead of 1.7″, all points represented by it, except one, would fall almost exactly upon the proper line. It is quite possible that each one of the pipes may be in error by .2″. If it were true that No. 4 pipe were .2″ further from the wall, and correspondingly all other pipes were changed, still all points would fall upon a good straight line due to the proportionate greater change effected by a distance of .2″ in that pipe nearer the wall. While it is our opinion that this outside pipe was actually located 1.9″ instead



of 1.7″ from the wall, yet we have not changed the points since, so far as our experimental data goes, it indicates the pipe to be located a distance of 1.7″ from the wall. In drawing these isotherms, it further should be remarked that, due to the initial high temperature at all points in the oven, the times at which pipe No. 4 was at 500 and 600° were taken by extending, smoothly, the temperature curve of this pipe. In a similar way for pipe No. 4, the temperatures of 500° and 600° are extrapolated values. All other points were taken direct from the time-temperature curves of Fig. 3. It is evident from Fig. 4 that, when any given temperature reaches a distance of 1.5″ from the center, the slope of its line increases sharply and that from this point to the center a quite different relationship holds. By the graphical determination of the slopes and intercepts of these various curves, we have arrived at the following equations representing the travel of the various temperatures up to 1½″ from the center.

500° F.	$y^{2.84} = 36\ \theta$
600° F.	$y^{2.53} = 15.8\ \theta$
750° F.	$y^{2.22} = 8.1\ \theta$
900° F.	$y^{1.82} = 3.55\ \theta$
1000° F.	$y^{1.70} = 2.86\ \theta$
1100° F.	$y^{1.59} = 2.21\ \theta$

From an examination of the above values for x and k, it will be seen that both decrease sharply as the temperature increases. It was desired to find if any definite relation could be established between temperature and the corresponding values of x or k, consequently, the values of x were plotted against the temperature on ordinary coordinate and semi-logarithmic paper and logarithmic paper. Reference to Fig. 5, where, essentially, the natural logarithms of x are plotted against the temperature in degrees Fahr. shows that this is a straight line, the equation of which is

$$(2.3)\ (\log x) = 1.552 - .00103\ t$$

where x and t are the corresponding values of x and temperature in degrees Fahr. In a similar manner, it was found that, by plotting values of k against the temperature on logarithmic paper, as shown in Fig. 6, that a straight line results. Obtaining from this line by its slope and its intercept, its equation, we find it to be as follows:

$$k = \frac{2.7}{\left(\frac{t}{1000}\right)^{3.75}}$$

By use of this equation for x and k, we find that k = 3 at a temperature 970° F., while at this temperature x = 1.75. In other words, at 970° F., $y^{1.75} = 3.00\ \theta$. It is interesting to compare this equation with that obtained entirely independently from the pressures, which, it will be recalled, was, $y^{1.76} = 2.54\ \theta$. By combination, then, of the equations derived from the pressures and those from the temperatures, we conclude that the zone of maximum pressure and, correspondingly, of plastic coal occurs at an average temperature of 970° F. or 520° C. Undoubtedly, this zone does not occur at one given temperature, but rather over such a range that the above value represents its average.

Unfortunately, between the center and 1½" from it, we had no sampling points, consequently, we have not felt justified in stating any equation showing the rate of travel as compared with distance from the wall. A possible explanation of the great increase in rate observed, as the center is approached, lies in the fact that, when any of the temperatures which we have considered has reached within 1½ inches of the center, between this point and the middle there is no longer any green coal which can absorb heat and, correspondingly, lower the temperature of that part of the coal which is in the coking process. In other words, when this coal is plastic there is a considerable evolution of heat which is, to a considerable extent, consumed in heating green coal so long as this be present. When there is no longer any green coal, this heat appears as a rapidly increasing temperature of that part of the coal which is coking.

Practical Application

In endeavoring to apply the results of our experimental work to actual coking, we find that we may consider the process to consist of three stages. First, the travel of the fusion zone to within 1½ inches of the center; second, the further travel of this fusion zone to the center; third, further heating of the now fully formed coke to give it strength and drive off the last of the volatile matter. We have been able to set up an equation representing the first part of the process which can be applied to an oven of any width on coal similar to the ones used in this test. For the second and third parts of the process, however, we have had insufficient data to warrant conclusions to be applied to ovens of other widths than the one here investigated. Furthermore, an additional requirement for the application of any of our equations is, of course, the maintenance of flue temperatures the same as those in use during our experiments. However, a consideration of our results leads to the conclusion that on ovens of different widths in which the same kind of coal is used and in which the same flue temperature is maintained, the ratio of effective widths of the ovens raised to some power should equal the ratio of coking times. In other words—

$$\left(\frac{W_1-1}{W_2-1}\right)^x = \frac{\theta_1}{\theta_2} \qquad \text{(III)}$$

where W_1 and W_2 represent the respective widths of ovens and θ_1 and θ_2 the coking times expressed respectively in inches and hours.

The deduction of one from the width is made to allow for a depth of ½" of closely adhering carbon to each of the heating walls. Unfortunately we did not have available the times corresponding to various widths of ovens; however, in February 1923 issue of the *Blast Furnace and Steel Plant,* values of this sort are given in an article by A. Ruehl, entitled "Relation Between Width of Coke Oven Chambers and Coking Time." Taking these values from Table II as given in this article,

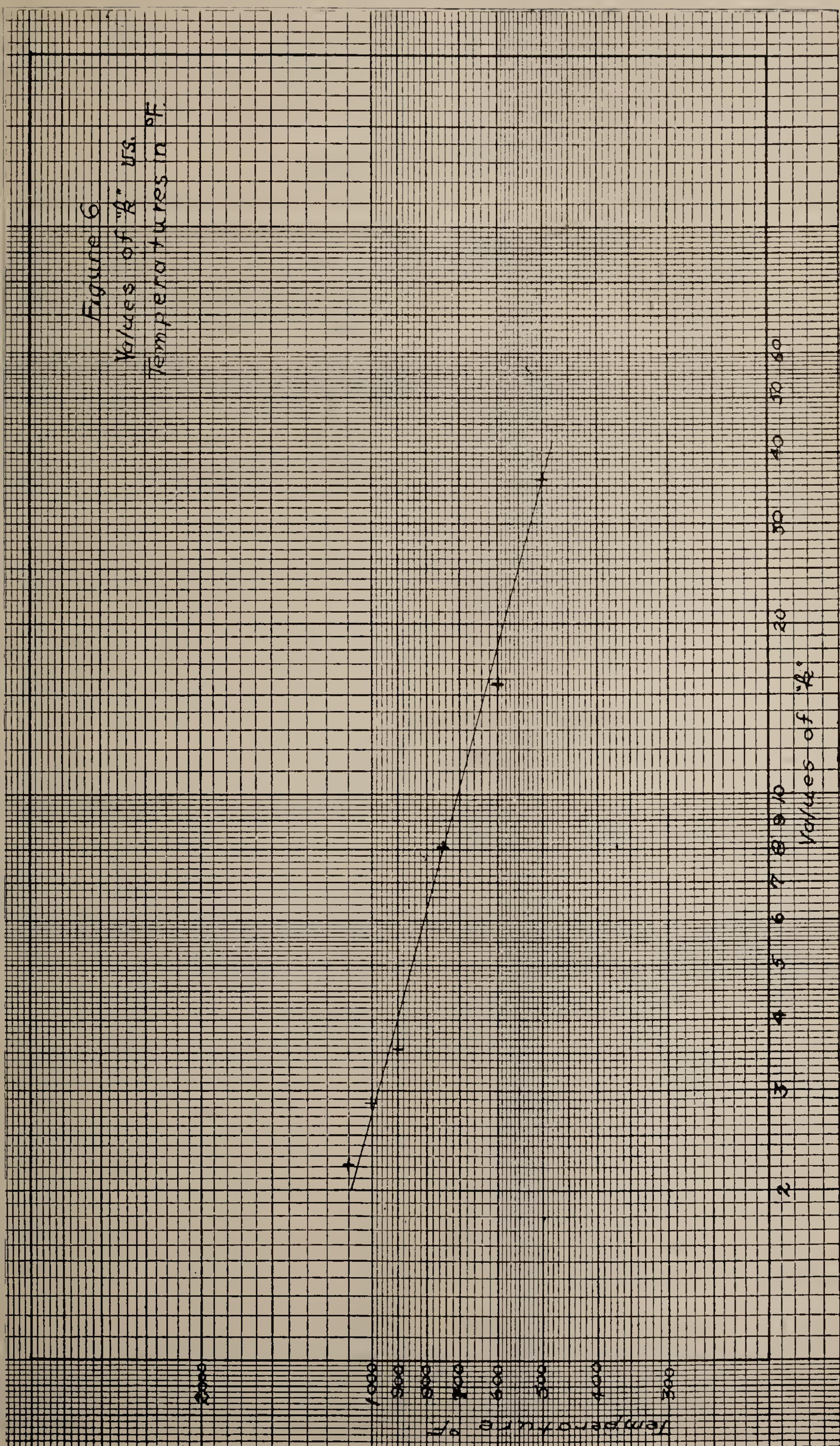


Figure 6
Values of "k" vs.
Temperatures in °F.
2
3
4
5
6
7
8
10
20
30
40
50
60
Values of "k"
2000
1000
900
800
700
600
500
400
300
Temperature °F

we find the value of x in equation III to be 1.5. Using this value of x and various pairs of coking times and oven widths as given in Table II, the following comparison can be made between the actual ratio of coking time and that calculated from equation III.

Actual	Calculated	Calculated According to Ruehl's formula
1.22	1.24	1.27
1.19	1.16	1.14
1.33	1.31	1.28
1.50	1.50	1.44
1.83	1.86	1.83

It can be seen here that the agreement between equation III and the actual values is very close and in these cases the oven width varies from 19.68 inches to 13.36 inches. It is interesting to note that with a coking time of 17 hours on an 18½ inch oven the corresponding coking time on a 14 inch oven is 11 hours.

With a given flue temperature and a fixed kind of coal then, the following equation holds

$$(W-1)^{1.5} = k\ \theta \qquad \text{(IV)}$$

Where W = mean oven width in inches and θ = coking time.

Solving this equation for the conditions of these tests, that is mean oven width of 18.5 inches and a coking time of 17 hours, k is found to equal 4.3, or

$$(W-1)^{1.5} = 4.3\ \theta \qquad \text{(IV)}$$

It must be mentioned again that equation IV holds only for a maximum flue temperature of 2500° F. and with ovens where the variation from this temperature during the coking will not be greater than in the ovens tested, as obviously changing flue temperatures will at once affect the coking time.

It would be of great value to determine the quantitative effect of known changes in flue temperatures upon coking time. The author has some information available regarding this from past experience, but it has not seemed as yet sufficiently complete to warrant its conclusion here. It is hoped that it can be reported soon.

Conclusion

In this paper primarily the following have been included:

1. Temperature and pressure curves are shown, indicating at four, or in some cases, five, points from the oven wall to the center, the behavior of the coal during coking.
2. The equation, $y^{1.76} = 2.54\ \theta$, has been derived from the pressure measurements only, as shown the progression toward the center of the zone of fused coal.
3. From the temperature measurement isotherms have been drawn indicating the travel inward of the temperatures 500° F., 600° F., 750° F., 900° F., 1000° F., and 1100° F.
4. Equations have been derived for each of these isotherms, holding only up to 1.5 inches from the center.
5. Comparison between the equation obtained from pressures and those for the isotherms indicates the fusion zone to occur at an average temperature of 970° F. or 520° C.
6. From data obtained from other published results, it is shown that, other conditions being the same, the following equation applies to practical coking operations:
   $$(W-1)^{1.5} = 4.3\ \theta$$
   where W = oven width in inches and θ = actual coking time—provided the maximum flue temperatures be 2500° F., the coals be similar to those of these tests, and also the variation in flue temperatures be not too great.
7. The phenomena of high temperature coal carbonization may be divided into three stages:
   (a) The travel of the fusion zone to within 1.5 inches of the center.
   (b) The further travel of this zone to the center.
   (c) Additional heating of the now fully formed coke to give it strength and to drive off the last quantities of volatile matter.

It is a pleasure to acknowledge here the very considerable assistance rendered both in experimental work and in treatment of results by Messrs. H. L. Rubens, H. I. Beadle and C. R. Myers, 2nd, students in this school, who recently were engaged in the investigation of this problem.

COMPLETE GASIFICATION OF COAL SECTION

W. R. MORRIS, *Chairman*
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REPORT OF THE COMPLETE GASIFICATION OF COAL SECTION

W. R. Morris, *Chairman*, Jersey City, N. J.

Introduction

In order that there can be no misunderstanding, it is the purpose of this report to consider by Complete Gasification a process which gasifies coal so that no solid residue other than ash remains.

Two stage processes, such as a coke oven plant combined with a blue gas plant, are numerous and thoroughly established and are not at all within the scope of this report. Neither have we considered producer gas plants, as they belong to the field of industrial fuels and can be reckoned only as auxiliaries to city gas manufacture. The primary object is to stay close to the ordinary interpretation of Complete Gasification as meaning a single-stage process. This brings us down to the manufacture of a gas ranging from 300 to possibly 390 B.t.u. value, which therefore, in its application to present day calorific standards can be no more than an adjunct to a city gas works.

Naturally the first question which arises is that of cost per therm, and it is from that angle of economic possibilities which we started out to present the status of Complete Gasification. At the first of the year, we felt that we would be successful in being permitted to present the actual operating cost figures and thereby clarify the whole situation. As the months passed one stumbling block after another was encountered until today we regret to say that no such figures are available.

In the report last year and preceding years, descriptions were given of the various Complete Gasification processes and their theoretical possibilities were thoroughly discussed. A repetition of such would be burdensome and additions to processes already covered by committee reports have been so completely presented in the technical periodicals that they need no mention here.

So far as we can learn, no new processes have been placed in operation since last year's report.

The one process which seems to be pushing itself forward as a theoretical possibility, is that of producer gas made from pure or 90% oxygen. Numerous investigations of this process have been made and Mr. Willien at this time very ably presents for you a summary of the whole problem as it stands today. To those familiar with the simplicity of producer plant operation, it is most attractive to think of making in that manner a gas of 350 to 375 B.t.u. value. The first obstacle is that of cost of manufacture of the oxygen and the next is the doubt as to what would happen in the hot zone of a producer when pure oxygen instead of air is used.

In England, many complete gasification plants were built during the stringent war times. Cheapness and speed were absolutely necessary and reports indicate that such developments are rapidly on the wane; moreover, considerable doubt is expressed as to their future success. In France there exists a regulation which forbids more than 15% carbon monoxide in city gas and where mixing of gas is desirable to regulate B.t.u. value, several complete gasification plants have been built as auxiliary gas making apparatus because of the slightly lower carbon monoxide content in that gas than in blue gas.

There is shown in Appendix A, a Bibliography of Complete Gasification Processes. This covers articles published subsequent to those contained in the Bibliography given as Appendix B of the 1922 Report.

Appendix A

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THE PROPOSED PROCESS FOR COMPLETE GASIFICATION OF COAL BY THE USE OF OXYGEN

L. J. Willien, Boston, Mass.

President Munroe made the following remarks before one of the Technical Sessions at the 1921 Convention in Chicago.

"I can see no line of undertaking where there is more to be accomplished or where there are greater prospects of accomplishments for the engineer than in the gas industry. All power to you and to your proceedings. I am sure that you will keep at it, that you will go on and on, and it will not be very long before there will come out of these meetings outstanding developments, changes in methods, that will make what we are accustomed to, look very poor by comparison. Some of you gentlemen are going to be able to give a gas from raw coal of 420 B.t.u.'s and we are going to have no by-products to handle or sell, nothing but ashes to take away from the coal. When you give that to us (and you are going to give it to us within the next five years) then the problem of the owner of gas property will be much simpler than it is today, when he must make coal gas with an enormous quantity of coke left as residue, which puts him into a business of a larger dollars and cents annual turnover than his gas business. You must not give us that kind of a process. You must give

us the other. Today we make coal gas and then try to use the coke up in our water gas. What we want is to have you give us a gas plant that will enable us to put coal in and take gas out and have nothing but cinders."

What President Munroe had in mind was a process which involves the complete gasification of coal. There is no doubt but that such a process will be the ideal way to make gas. A great deal of work has been and is being done on the development of such a process. During the past three years the Carbonization Committee has had a section which has kept in touch and reported on the various processes that have been proposed for the complete gasification of coal. All of the processes reported are in the experimental stage and at this writing it is not possible to predict from the data submitted when any of them will become a commercial success.

The purpose of this paper is to present the gist of the data available on the proposed process of completely gasifying coal in a gas producer using 90% oxygen and steam continuously instead of air and steam intermittently. The figures given in connection with the operation to be expected from such a process were all derived from theoretical or, in some cases, arbitrary consideration of the process.

The use of oxygen instead of air in gas producers was discussed in a paper presented before the Gas Institute in England by H. J. Hodsman and Professor J. W. Cobb in 1920 (Gas World, June 5, 1920, page 510). Mr. E. W. Jefferies of the Jefferies Norton Corporation, Worcester, Mass., presented a paper on the same subject before the New England Association of Gas Engineers in 1921. Professor R. S. Tour of the University of Cincinnati has been interested in the proposition for some years and has submitted some figures in connection with the process.

The figures obtained from the above sources are given in a table at the close of this paper. The figures submitted by Professor Tour were arrived at from theoretical physico-chemical considerations of equilibria and reaction rates, using constants and temperatures derived from standard operations of air producers and water gas generators. Mr. Jeffries' figures were obtained by taking the average result obtained on "Morgan Producers," using air and steam and arbitrarily reducing them to a 2% nitrogen base, assuming that with oxygen there will be some improvement in the percentage of the hydro-carbon gases due to the additional hydrogen and the longer period of its contact with the hot fuel and nascent gases, as compared with producer gas. Mr. Jeffries, however, did not take into consideration the fact that the absence of the nitrogen would change the reaction characteristics and temperature within the producer, and affect the steam consumption. Messrs. Hodsman and Cobb used as the basis for their calculations the results obtained for the production of straight coal gas in the Gas Investigations Committee's investigation at Uddingston, because they were the most complete and reliable on hand. They assumed the process of complete gasification to consist of two successive stages: carbonization, followed by gasification of the resulting coke. For the gasification with oxygen they made the assumption that the steam was completely decomposed (no excess) and that the reaction was entirely to CO and none to CO_2, both assumptions being far from practice as indicated by reactions in water gas machines.

In each case the heating value of the resultant gas is too low to meet the legal requirement enforced in this country, and it would, therefore, be necessary to enrich the gas. The best method of enriching such a gas presents an interesting problem. It would require from 2.0 to 2.75 gallons of gas oil per M to enrich it to 500 to 550 B.t.u.'s. The sensible heat in the gases leaving the producer would not be sufficient to gasify the gas oil. It is the idea of all investigators to have the temperature of the gases leaving the producer as low as possible, for improved carbonization of the coal, for the production of a higher quality tar and for increased thermal efficiency. It might be possible to have the gases from the producer pass through a carbureter and superheater into which sufficient oxygen was introduced to burn the amount of gas required to gasify the gas oil. This is similar to the Dayton process, in which oil is burned in sufficient amount to generate the heat necessary to gasify an additional quantity of the oil. Probably the best arrangement at first would be parallel operation of the oxygen producer with an intermittent carburetted water gas installation, the latter supplying a high B.t.u. gas for admixture.

The following are some figures on oil gas made by the Dayton Process using an ordinary gas oil. The second column is based on using 90% oxygen instead of air.

	Air	90% Oxygen
Gallons of oil per M	5.3	12.0
Cu. ft. of oil gas per gallon	189	83.3
B.t.u. per cu. ft.	500	1210
Gas Analysis		
Carbon Dioxide	6.0%	14.5%
Unsaturated Hydrocarbons	15.9%	38.4%
Oxygen	.1%	0.2%
Carbon Monoxide	6.7%	16.2%
Hydrogen	2.3%	5.6%
Saturated Hydrocarbons	8.7%	21.0%
Nitrogen	60.3%	4.1%
	100.0%	100.0%

Assuming that the nitrogen in the gas shown in the first column comes from the air, the amount of 90% oxygen that will be required per M of oil gas is 174.5 cu. ft. or 32.9 cu. ft. per gallon of oil. In practice these amounts may be reduced, since there will not be the large amount of nitrogen to heat when using 90% oxygen, as there is when using air.

In order to produce 500 B.t.u. gas it would be necessary to enrich the coal gas from complete gasification (350 B.t.u.) with 17% of oil gas (1210 B.t.u.). For a 550 B.t.u. gas 23% oil gas would be required.

The ability to control the temperature of the hot zone in the oxygen producer is something which may prove to be a problem. During the war, at the Edgewood Arsenal, pure oxygen and carbon dioxide were used with coke in a water gas generator for the production of carbon monoxide. It was found that the reaction between the oxygen and the carbon of the coke took place first, developing an extremely hot zone, and that the reduction of the carbon dioxide occurred higher up in the fuel bed. The result was that the generator linings burned out very quickly. By the use of oxygen and carbon dioxide they succeeded in making 97% pure carbon monoxide. Although the reduction of carbon dioxide is an endothermic reaction as well as the steam-carbon reaction Professor Tour points out that at temperatures above 825°C (1500°F) steam rapidly becomes a more powerful oxidizing agent, (is more easily reduced by carbon) than CO_2. Professor Tour further points out that at Edgewood it was necessary to maintain high concentration of the reaction products (CO) with very low concentration of the reacting gas (CO_2) which condition requires cumulatively increasing tempera-

ture, whereas in the steam-carbon reaction, excess steam is not objectionable (in that it condenses out) and also a slightly increased CO_2 can be tolerated.

Professor Tour believes there would be even less trouble with the temperature in a producer using oxygen and steam than there is at present in the control of an intermittent water gas generator. Such a process he believes would have the advantage of a steady condition of temperature whereas the rising and falling temperature of a water gas generator is largely responsible for the clinker trouble. Professor Tour further believes that in a producer using oxygen and steam the location of the hot zone, the extent of the hot zone, and the temperature of the hot zone would be a function merely of the load placed upon the machine and the proportion of steam and oxygen and that probably clinker and ash removal could be made continuous with little difficulty.

The proposition of using oxygen in gas producers is dependent upon the ability to produce a 90% oxygen cheaply. Whether cheap oxygen in this case means $1.00 per M or 25 cents per M it is difficult to say. The charge against the issuing gas would in each case be respectively 23 cents and 6 cents per M against which should be credited the total overhead and operating cost of the retort benches displaced as well as the decrease in overhead, operation and fuel consumption of the water gas machines superseded. There is no doubt that the cost of oxygen with present day methods is well under the first figure, and probably with the demands made by the gas industry should this process be developed, the last figure can be soon attained.

There is a total of but 3,000,000 cubic feet of oxygen produced per day at present in the country, all in very small installations compared with those the gas industry would need. Some of this is produced by the electrolytic process, but the majority of it is produced by the liquefaction process, which consists of liquefying air and separating the oxygen from the nitrogen by fractional distillation. All of this oxygen is compressed into steel bottles and 95% of it sold for cutting and welding. This oxygen runs 98.5% to 99.2% pure. The cost of producing it may be around $5.00 per M which makes its use for gas making prohibitive. In actual practice, the electrolytic process operates at 60-80% efficiency but has a very high energy consumption since it must decompose water to obtain its oxygen. The efficiency of the liquefaction processes run about 10%. The latter, therefore, affords a great margin in which to increase the efficiency and thereby reduce the cost. It must be remembered that the power charge may be less than half of the final cost of this oxygen and increases in efficiency must not be at the expense of increased overhead or operating charges. Reducing the purity of the oxygen reduces the cost of production in a much greater ratio than the reduction in purity, and this is the reason for considering the use of 90% oxygen; even 85% oxygen would be suitable. Professor Tour estimates the investment cost of an oxygen plant (using the Claude process and producing 90% oxygen in the capacities necessary for making gas) to be $1.00 per annual 1000 cubic feet of 90% oxygen. The operating cost for such a plant he estimates as follows:

	Per M of 90% Oxygen
Power 20 k.w.h. at 1.0 cents	$.20
Fixed charges of 20% of $1.00	.20
Labor, Materials, Incidentals	.05
	.45

The fixed charges include depreciation of 12½%, interest 6%, taxes and insurance 1½%. Professor Tour believes it fair to assume that the cost of 90% oxygen in large capacities will run under 50 cents per M with present day methods.

The complete gasification of coal by the use of oxygen is the most promising proposition that has been proposed. If 90% oxygen can be manufactured at a cost of 50 cents per M or less, its use in the production of gas assumes a very interesting aspect and the gas industry should proceed to determine the feasibility of the process. A study of this problem would make a very interesting piece of research for some of the students taking fellowship courses supported by the different associations. As stated at the beginning of this paper, the process has never been tried, even on an experimental scale. Experiments should, therefore, be made to determine:

(a) The amount and quality of gas that can be obtained per unit of coal, and

(b) The control of the temperature in the hot zone by the use of steam.

We all can remember the time when there were no flying machines or automobiles. The first flight of a flying machine lasted only twelve seconds, and averaged thirty miles an hour. A short time ago, a flying machine made a nonstop flight from New York to San Francisco in less than thirty hours. When the automobiles first came out, one dared not venture very far from home for fear he might not get back without being towed in. Today a car that will not travel a thousand miles or more without a breakdown is practically no car at all. It is not to be inferred from this that the gas industry is not progressing, but the idea is to bring out more forcibly President Munroe's remarks to the Technical Section in 1921.

The following is taken from an article by Floyd Parsons in the Saturday Evening Post for May 5, 1923, which I believe is appropriate for ending this paper.

"The big lesson in all this is that we have passed the time when it is safe even to say that certain elements have such-and-such qualities. We know now that there is no such thing as a product, a process, or even a faith that does not alter

	Prof. Tour	E. W. Jefferies	H. W. Hodsman & J. W. Cobb Carbonization with Steam	Complete Gasification
Cu. Ft. Gas per ton of coal	63500	66340	18650	61700
Steam required per ton of coal (lbs.)	1810	600	118	674
Steam required per M of gas (lbs.)	28.5	9.05	6.34	10.9
Cu. ft. oxygen required per ton of coal	14350	13600	2030	11000
Cu. ft. oxygen required per M of gas	*226	205	109	178.5
Composition of gas				
Carbon dioxide	7.7%	3.0%	1.1%	0.33%
Illuminants	.6%	1.4%	1.1%	.35%
Oxygen	0.0%	0.0%	0.1%	.06%
Carbon Monoxide	51.4%	58.0%	41.9%	63.20%
Methane	5.2%	7.6%	14.2%	4.26%
Hydrogen	32.2%	28.0%	38.3%	30.80%
Nitrogen	2.9%	2.0%	3.3%	1.00%
	100.0%	100.0%	100.0%	100.00%
B.t.u.	341	375	427	352
Specific Gravity	.67	.65	.57	.74

*90% oxygen, 10% nitrogen

with time. The impossibilities of one decade become the realities of the next. The modern man of business is no longer content simply to have his product the best among its contemporaries, but rather it must be the best among its future competitors. No less far-sighted policy in industry is at all safe. Things made by hand today are made by machines tomorrow."

This process may appear to many of you to be an idle dream, but I believe that it will be eventually worked out on a commercial basis, that is— it will be possible to produce 90% oxygen at a cost of 50 cents or less per M, and to use this oxygen with steam and gas coal in a producer completely gasifying the coal, and leaving only the ash as a residue.

I believe you will all agree that the ideal process for making gas is one in which the coal is treated in such a way that there will be only gas and ashes produced. The whole object of this paper is to start some of you thinking on this problem of the use of oxygen in the manufacture of gas, with the hope that one of you will solve it, and put it on a commercial basis.

In closing, I wish to extend my appreciation to all those who have submitted data which has been incorporated in this paper, especially to Professor R. S. Tour, who has submitted the bulk of the data.

LOW TEMPERATURE CARBONIZATION SECTION

C. V. McINTIRE, *Chairman*
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REPORT OF THE LOW TEMPERATURE CARBONIZATION SECTION

Charles V. McIntire, *Chairman,* New York, N. Y.

The past year has witnessed a marked revival of interest in the subject of low temperature carbonization. In the face of several well known failures in this field both the engineer and the layman continue to feel that the pressing need of a suitable substitute for anthracite coal as a domestic fuel,—a need which was brought in to high relief by the recent coal shortage,—will be met by some process of low temperature carbonization. At any rate, the interest exists as is shown by continued references to the subject, not only by the technical press but also by the daily news sheets, and the object of this paper is to set forth certain misconceptions held by many concerning the advantages they believe can be gained in the practice of the art; to point out some of the difficulties which lie before those who are undertaking to solve the problem; to give a brief outline of the work which is under way in the United States for the commercialization of Low Temperature Carbonization; and to touch upon some of the processes now before the public in England and Germany.

The distillation of coal at low temperature holds a certain fascination for the layman as well as for the chemist and the inventor, and this combined with the wide publicity given to the subject recently has been taken advantage of by promotors. It should be said here that there have been no developments along low temperature lines in this country or in England which would justify any assumption that the art has passed from the experimental into the commercial field. Distillation of coal at low temperatures has most certainly not been done on a commercial scale—by that is meant a money-making scale, yielding profits sufficient to carry the operating costs and the capital charges. It has been tried experimentally; on a semi-commercial scale, and in one case in a full sized commercial plant, but it must be recognized that so far none of these attempts have been entirely satisfactory. The laboratory results remain the most satisfactory of the three phases in their promise of financial returns.

No process has yet made public any data which would justify the small investor in investing in it, and the fact should be known that the development of any process is a matter only for the large capitalist, and then only after careful investigation by competent engineering authority.

One of the greatest misconceptions held with regard to Low Temperature Carbonization, even on the part of some technical men, is the assumption that the by-product yields from low temperature processes are so superior in value to those derived from high temperature

processes that the revenue from them would immediately remove low temperature coke from all fear of competition with by-product coke.

It is a fact that the published matter relating to processes almost invariably gives optimistic accounts of the by products to be obtained from the treatment of coal. In many cases the data so published are derived from small scale experiments in which temperature and other conditions do not parallel those which would obtain in large commercial apparatus, and are therefore meaningless. Such results are misleading, not only for the reason given but because they do not agree with one another.

It should be pointed out that as yet no large scale installation of low temperature carbonization retorts has operated for a sufficient period to establish a market for low temperature by-products. It is true that the Corbocoal plant at Clinchfield ran for nearly two years and sold quantities of tars and other products, but, on the other hand, it must be remembered that these tars were not truly low temperature tars and also it may be said that their marketing was not an easy matter. That project plainly indicated, however, that while a market existed it could only be reached by the large producer who was willing to invest heavily in research work and who had a well-equipped selling organization.

When low temperature tar is made in large quantities and the fractions become available to the industrial arts, a market will undoubtedly arise to absorb them,—most authorities agreeing that these tar oils are potentially more valuable than the secondary tars of the coke oven. This market is now undeveloped and therefore it is the writer's opinion that low temperature tar, if manufactured and sold as raw tar at the present time, would bring only a slightly higher price per gallon than the tar made in the modern by-product coke oven.

Continuing the comparison between low temperature products and those from the coke oven, it may be said that although the primary tars sell in the present market for prices only slightly greater than those of the coke oven, the total revenue from them is much greater, on account of the larger quantity obtained per ton of coal. This showing in favor of the low temperature process, however, is almost balanced, under present conditions, by the much larger quantity of salable gas produced by the coke oven. Ammonia yields are also in favor of the coke oven. On the whole, with respect to by-products, the same rules which govern the economics of the modern by-product coke oven will also apply to the low temperature processes and those rules in part are:

1. The coke residue must be sold at a price considerably higher than the price of the raw coal from which it is made. This precludes those schemes which have as their object the treatment of coal for the removal of by products and the use of the coke or semi-coke as boiler fuel. Coke cannot compete under present conditions with raw bituminous coal as fuel for power plants.

2. The installation must be of large capacity in order to spread out the overhead costs and the selling expenses. About 1000 tons daily capacity is the smallest size which should be considered under present conditions of high construction costs.

There is apt to be some misconception held regarding the inherent qualities of the residue or coke which is the main product of low temperature carbonization

processes. It is sometimes assumed that because this coke usually contains more volatile matter than ordinary by-product oven coke it is therefore superior to it in every way as a domestic fuel. The fact is, there is a wide difference of opinion as to just what low temperature coke is, or will be when it is made commercially. The men who are backing the various processes do not agree with one another as to the nature of the product they are striving to produce. Some are trying to make, in a one stage process, a coke possessing all the excellent physical characteristics of by-product coke plus a relatively high content of volatile matter, to give it free burning qualities; some wish to produce a semi-coke, high in volatiles, porous and soft in structure, similar to what is called Coalite; others have as their objective a small sized porous semi-coke which they intend to prepare for the market by briquetting methods after the fashion of the Carbocoal Process. All are striving to make the ideal smokeless domestic fuel, an anthracite substitute. The coke oven operator thinks that he now has that fuel. Those who are working with low temperature carbonization do not agree with him and the question will not be settled until a fuel is manufactured and sold commercially, over a long period of time, which proves by its performance and by the reception given it from the public that it is better than what we now have. It should be noted here that Carbocoal, the briquetted and redistilled product of the largest attempt at low temperature carbonization in the United States, was well received by the public during the short period of its production. It is not the purpose of this paper to define the ideal domestic fuel; that will be left for the public to decide when the various substitute fuels are put on the market, in competition with anthracite and with domestic coke; but we wish to set down the opinion that low temperature coke is not inherently superior to coke oven coke unless it is improved physically by briquetting or some other means.

Bearing on this subject it may not be amiss to quote a paragraph from the English "Gas World," of June 2, 1923, regarding the public reception given the well known Coalite:

"... Time and again professors.. are found writing to the newspapers on this subject, (Coalite) with more or less appreciation of the facts, but ending up with the unproved assertion that a kind of solid fuel exists, and is available, which is qualified as a perfect substitute for household coal . . . This reputed substitute for house coal is not on the market, for good and sufficient reasons, which evidently have not penetrated to the professorial intelligence, although these must be recognized in the fuel markets and in the homes of the people . . . . Not one housewife in ten thousand has ever bought a bag of 'coalite,' and those who have show no eagerness to repeat the order."

This review cannot deal with the relative merits of the different processes. This is largely a matter of opinion and individual judgment at present, and it is not likely that any one particular process will have a monopoly in a field so wide and with so many intermediate applications. A brief description of several American processes which are before the public at this time and one or two European processes follows:—

The Carbocoal Process

The Carbocoal process, the invention of Chas. H. Smith, has been described in a number of publications, but by far the most complete and accurate history of its development is to be found in the recent papers by Harry A. Curtis, formerly

general manager of the Clinchfield Carbocoal Corporation and now Professor of Chemical Engineering at Yale University. Curtis not only describes the present state of the process but he details the experiences of the inventors with the earlier apparatus, and his comments on the difficulties encountered should serve as a guide for anyone entering upon a course of experiments in low temperature carbonization. Of course, some of the difficulties were due to local conditions and might not be met with again on similar experiments. It is worthy of note that these papers are about the only ones of their kind which bring out the troubles and annoyances encountered in connection with a new process. Most of the published matter concerning other processes has told of the hopes of the inventors, the plans for development, and the wonderful things to be expected of them. The Clinchfield plant of the Clinchfield Carbocoal Corpóration was operated under a license from the International Coal Products Corporation; its earnings were never satisfactory, and in the fall of 1922 the plant was shut down completely and still remains idle. The process has been taken over by the Consolidation Coal Products Company, with offices at 67 Wall Street, New York, and a new series of experiments have been started at an experimental plant in Fairmont, W. Va., under the direction of Messrs. Coverdale and Colpitts, Consulting Engineers, of 66 Broadway, New York. The experiments will include exhaustive tests, conducted in a scientific manner, on two or three types of retorts, both of commercial size, which will be built within a setting provided to accommodate them. The setting is complete at this writing and preparations are being made to start the first experiment on a retort of the carbocoal type, but of much larger dimensions and of sturdier construction than any heretofore built. No claims are made by the principals or the engineers in charge, but the results will be known before the 1923 report of this Committee appears and will probably be published at some later date.

The writer, who is largely responsible for the design of this plant, has been retained by Messrs. Coverdale and Colpitts to have active charge of this experimental work.

The Piron Process

The Piron process, which has been taken up by Henry Ford, is being installed by the Ford Motor Company, Ltd., at Walkerville, Ontario. The process is sometimes called the Caracristi process after V. Z. Caracristi, Consulting Engineer, 43 Broad Street, New York, who is associated with Piron and the Ford Motor Company, Ltd., in the project. A complete description of the retorts and of the claims for the process will be found in "Power" of May 29, 1923, to which readers are referred for further details.

The process resembles that of Richards and Pringle, in that it has a continuous metal conveyor for carrying the coal through the retort and discharging it at the other end. The main difference lies in the fact that Piron has added a lead bath extending the full length of the furnace which conducts heat, from heating flues passing through it, to upper strand of the conveyor which floats on the molten lead. The unit, designated by the inventor as one retort, consists of a brick setting containing two parallel retorts or ovens each 9 feet wide and each containing 3 separate conveyors 3 feet in width. Each oven consists of two chambers, an upper and a lower one, each about 45 feet long. Cast iron housings, projecting beyond the brickwork settings at both ends

of the retorts, enclose the shafts and sprockets for the conveyors and have openings for coal feed, coke discharge, and gas outlet. Rectangular cast iron heating flues are placed transversely on the floor of the upper chamber thus passing through the lead bath which they heat to the required temperature. These flues connect with vertical combustion flues at the sides of the setting and these in turn connect at their upper ends with a pair of regenerators mounted above the upper chamber. The fuel used is gas and the flames in the flues are reversed periodically, the regenerators being arranged to recover excess heat from the products of combustion in the usual manner. Between and over the heating flues is the molten lead bath, supported by the clay brickwork of the upper chamber floor. Water cooled pipes extend crosswise through the brickwork about eight courses below the lead and serve to congeal any lead which may seep through the cracks or joints, and thus prevent its escape.

As mentioned above, there are three main conveyors in each furnace; each consisting of flat links or platens of cast iron, 3 feet wide by 18 inches long, connected by steel pins. These conveyor plates are maintained at a temperature of 1200 degrees F. Coal is fed in a layer one-half inch thick onto the feed end of the conveyor and is carried through the retort at such rate as to reach the other end in less than four minutes, which is said to be the time required for carbonization. The soft coke is dumped upon an auxiliary conveyor which travels in the lower chamber and in opposite direction to that of the main conveyor. This lower or return conveyor is in contact with the lower strand of the main conveyor and is said to assist in removing any coke which may stick to the latter. The coke falls into a discharge hopper from the lower conveyor directly below the coal feed to the upper conveyor.

It is said to require only five horsepower to drive all the machinery of each unit, including the conveyors and the feeding devices.

The Canadian plant, now being constructed, is rated at 400 tons of coal per day, all of the coke from which will be used in pulverized form under the power plant boilers. The ultimate capacity of another plant which is projected for the River Rouge plant of the Ford Motor Company is 4000 tons of coal per day. Part of the semi-coke from the latter is to be used as a substitute for Pocohontas coal in the Semet-Solvay coke ovens and part is to be burned in pulverized form. The semi-coke is of a peculiar soft, spongy structure which will not stand handling; it may be briquetted for domestic purposes or pulverized for power plant boilers.

An experimental furnace of this type has been built at Huntington, W. Va., and has been put into operation during several periods in 1922 and 1923. It is understood that the experimental plant is not equipped with apparatus for measuring the exact quantity of gas or by-products obtained from distillation, so it must be assumed that the results quoted in "Power" are laboratory results.

From a purely theoretical angle Piron's methods have much to commend them. Coal is spread in a thin layer and carbonized quickly by heat emitted from metal plates, while the gases of distillation are removed as soon as they are formed, preventing secondary decompositions of the by-products. With processes in this stage, the difficulties to be overcome are generally mechanical in na-

ture and probably the Piron will be no exception, in fact, Mr. Caracristi, in the article mentioned, admits that there are a number of problems yet to be worked out on a commercial scale. The development at the Ford Motor Company will be watched with interest.

The Greene-Laucks Process

The Greene-Laucks process, which has been under development by the Denver Coal By-Products Company at Denver, Colo., for several years, remains practically as described in the 1921 report of this section. Minor changes in dimension have been made in the retort so the following description of the present state of the process may not be amiss.

The retort consists of a vertical cast iron cylinder 12 inches inside diameter by 12 feet high within which revolves a centrally located cast iron pipe 8 inches outside diameter. Around the latter and extending from the inner to the outer pipe are a series of helical screw flights about 12 inches pitch which receive the coal from a loading device at the bottom of the retort and screw it upward, in a layer about 9 inches thick on each flight, discharging it as coke at the top. The gases of distillation travel upward through the space between the top of coal and the bottom of the next flight and leave at the top through a pipe. No special vacuum is used as was the case in the former Greene-Laucks practice. Heat is applied by means of a gas burner system to the outside of the large pipe and to the inside of the center pipe, the temperature being maintained at about 750 degrees F. in the shell.

While there is undoubtedly some agitation of the coal mass during its upward passage, it can not be vigorous, or the coke would be broken and splintered, or dusty, whereas, it is said to come out in large pieces with very little braize.

This process has been investigated by a number of interested parties, including the Combustion Engineering Corporation who conducted tests at the Denver plant for several months, but it has not as yet been taken up and commercialized. A recent report, unconfirmed at this writing, is to the effect that the Old Ben Coal Company of Chicago, acting on the recommendations of an engineer's report, has decided to install a large plant using this system at or near Chicago, for the purpose of manufacturing a smokeless domestic fuel for the Chicago market.

The Wallace Process

The Wallace process is the invention of G. W. Wallace who developed it first at a small gas plant in East St. Louis and in 1921 built a semi-commercial unit consisting of about six retorts at Petersburg, Va.

The retort consists of a vertical fire clay brick shell, rectangular in cross section, in the center of which is a hollow perforated metal core of such shape and dimensions as to leave a space of about four inches between the metal and the retort shell. The core is mounted on a cast iron base which fits into the lower door of the retort and registers with a gas offtake just above the door. Means are provided for removing the core and for replacing it in the retort. Coal is charged into the space around the core and is distilled by the heat from the walls; the primary gas leaving the plastic zone on the side away from the heat and traveling through the coal into the hollow core down which it passes and is carried off by the usual main; lean gas, evolved from the coke between the plastic area and the wall, is withdrawn upward

through the coke and out through a main at the top.

The temperatures used approach those common to high temperature carbonization and the coke is said to be of excellent quality, but the by-products possess characteristics similar to those derived from low temperature distillation; the reason being that the rich primary gases, carrying the low temperature oils, are taken away from the coal on the side away from the heat without coming in contact with the hot walls.

The Petersburg plant was in operation during 1921 and 1922 under the direction of Mr. Arthur W. Warner. The experience gained led to the development of another process known as the Petersburg process, now being covered by patents, which, together with the original Wallace patents, are owned by the Economic Carbonization Company, S. P. Curtis, President, American Gas Company Building, Philadelphia. The company plans to erect a plant consisting of four 5-ton retorts at Petersburg and to operate it on a commercial scale by selling the coal gas to the city.

The Bussey Process

This system is described in the 1922 report of this section and no material progress has been made in the physical features of the plant at Louisville, Ky., since that writing. It is understood that several investigations have been made of the plant, which is of semi-commercial size, and that Messrs. Parker and Wilder, Coke Oven Engineers, of Cincinnati, Ohio, have interested themselves in it for the purpose of putting it into commercial operation.

The Richards and Pringle Process

This system, developed in England by Messrs. Richards and Pringle, was investigated by R. L. Rodgers, of Chicago, and a small plant consisting of one retort was built by him and his associates in 1921 at Hammond, Indiana. The unit was of commercial size and was operated for a period of two or three months in 1921, but the mechanical difficulties encountered made it unwise to continue operation and it is reported that the process has been abandoned. The retort consists of two long chambers, set one above the other; the upper chamber being heated to a temperature of about 1200 degrees F. The ends of the chambers are fitted with steel plate housings carrying sheaves and idlers for a pan conveyor which travels forward through the upper chamber and returns through the lower one. Coal is loaded on the conveyor to a depth of about four inches, and is carried through the hot zone and converted to a semi-coke or Coalite containing ten to fifteen per cent volatile matter. At the other end the Coalite is scraped from the pans and prepared for the market.

The Babcock Process

The Babcock process is the development of Dean Babcock of the University of North Dakota and was demonstrated at the School of Mines Experimental Station, Hebron, N. D. The state of development of the process, which was in operation in 1920, 1921 and 1922, is described in a bulletin issued by the U. S. Bureau of Mines, based on a test conducted at Hebron by the Bureau in 1921.

The retort, which is of the by-product recovery type, consists of a series of small rectangular chambers of fire brick set at an angle of forty-five degrees and mounted in a battery. Heating flues run transversely below the retorts and the flames travel through the flues in series, entering at the bottom and leaving the top. Lignite under two inches in size

enters the tops of the retorts and passes downward over the heated floor and under several baffles in the roof, being withdrawn at a measured rate as coke at the bottom by means of a revolving gate. Gas is taken off through openings in the roof and carried to the by-product system.

Experiments have been conducted in briquetting and most excellent briquettes have been made, using the lignite char with an asphalt and flour binder.

The battery has a capacity of about twenty tons of lignite per day. It has been operated successfully over several periods of several months each and proved to be mechanically sound but the output of lignite was low compared with the cost of construction and from an economical standpoint the system was not an entire success. The writer believes this view to be corroborated by the action of the University in installing the Hood-Odell retort at Grand Forks in 1922.

The Johns Process

This apparatus was developed by Johns in an experimental plant in Denver in connection with the distillation of oil shale, and the process is now owned by the Industrial By-Products Company, 25 Broadway, New York. A further development program, leading to the installation of a by-product plant at Rockdale, Texas, has been entered upon and a new company, the Empire Fuel Products Corporation, has been organized for this purpose, the capital stock of which company has been offered for sale by J. W. Bell and Company, 56 Pine Street, New York, on the strength of an engineering report by Hutton Blauvelt, Consulting Engineer, 120 Broadway, New York. It is the intention of the owners to carbonize the lignite of the Rockdale region and after briquetting it supply it to the trade as domestic fuel.

The carbonizer consists of a chamber 4 feet wide, about 18 inches high, and forty feet long, set at a slight incline with the horizontal within a brick setting. The roof is composed of removable plates; the floor is of carborundum blocks about two inches thick. Heating is done by the combustion of gas in a chamber located at the discharge end, the products of combustion passing lengthwise under the floor through two large flues. Crushed lignite enters the higher end of the inclined floor and is moved along during the progress of the distillation by means of a series of paddles which alternately lift, move backward, lower and then slide forward, exactly in the fashion used by the Colorado Iron Works in one of their driers. At the lower end the material is withdrawn by a screw device and quenched. Gas is taken out at several points in the length of the retort and passed to the condensing apparatus.

It should be noted that the prospectus, upon which the above mentioned company was financed, showed products from the proposed plant on the basis of laboratory tests made by the International Coal Products Company, and not upon the results obtained in the experimental operation at Denver. The writer has no knowledge of the progress made at Rockdale.

The West Process of Manufacturing Metallurgical Coke

A recent United States patent issued to Mr. West, of the Jones and Laughlin Steel Company, Pittsburgh, discloses the fact that at least one expert on metallurgical coke has interested himself in low temperature carbonization. The patent specification tells of certain experiments

carried out in connection with the manufacture of blast furnace coke, the object of which was to improve the physical properties, particularly the strength, of the coke by adding a quantity of semi-coke (not more than 50 per cent of the mixture) to the usual high volatile gas coal, and charging the mixture in a by-product coke oven. This indicates an attempt to use the residue from low temperature carbonization as a substitute for the Pocohontas coal of the standard coke oven coal mixture and the results of West's research if successful, will probably be of far reaching benefit to the industry.

International Combustion Engineering Corporation

To show the interest taken in the subject of low temperature carbonization, it should be noted that the International Combustion Engineering Corporation, 43 Broad Street, New York, manufacturers of stokers, have been investigating the subject for several years and recently have retained Walter Runge, consulting chemist, 2 Rector Street, New York, to assist them. Dr. Runge went to Europe to look into one or more processes there. The result of his search has not been made public.

The Pintch Process

The Pintch process, outlined in the 1922 report of this section, has been offered for sale to one or more American firms and has been investigated, we are told, by a large manufacturer of stokers. No plants have been built in this country.

The Brown Process

The Brown process is owned by the Shale Oil Machinery and Supply Company, 342 Madison Avenue, New York, and is offered for sale by them as a method for treating shale or carbonizing coal, It was designed for the purpose of distilling shale, and is said to have been successfully used in a semi-commercial way in that field. The retort consists of three horizontal, externally heated, revolving drums set end to end within a brick kiln and connected by stuffing boxes. The material to be treated enters one end through a feeder, passes along the three drums under the action of propelling vanes or lifters and discharges at the other end. Each drum is separately driven. This system differs from the Thyssen and other revolving drum retorts in that it is divided into three drums lengthwise, each one of which may be revolved at a different speed, but just what advantages these features add are not clear to the writer.

The Summers Process

The Summers process, described in the 1921 report, still remains in the experimental stage and no steps have been taken to commercialize it. The original installation, consisting of three ovens, is still at Harrisburg, Ill. It must be pointed out that this process should not be included in a list of low temperature systems, as it certainly belongs in the high temperature class, being nothing more or less than a continuous high temperature by-product coke oven, provided with means for compressing the coal charge during carbonization.

The Lignite Board's Carbonizer

This system, described in the 1921 report of this section as the Stansfield Carbonizer, is a development of the Lignite Utilization Board of Canada, R. A. Ross, Chairman; Leslie R. Thomson, Secretary, Montreal; a body financed by the Canadian Government to find the most suitable method of utilizing the enormous

lignite deposits of the Canadian Northwest. The first development work was carried on by the Board in a small scale test unit at Ottawa, in connection with a series of scientific experiments by the Dept. of Mines. At the completion of this work a semi-commercial plant of two hundred tons daily capacity, consisting of six carbonizers, two driers, briquetting plant, coal handling department, by-product recovery system, power plant and other accessories, was erected at Bienfait, Saskatchewan. This plant has been in operation for two or three periods during the years 1921, 1922, but, while the performance is characterized as having demonstrated correct principles of design, it is stated that the results were not altogether satisfactory. Many difficulties were encountered and, as it would require the rebuilding of the retorts to rectify them, the plant has been shut down. Through an arrangement with the United States Bureau of Mines, a carbonizer designed by O. P. Hood, chief mechanical engineer, and his assistant, Mr. Odell, is being constructed at Bienfait by the Board and will be ready for operation this year.

The Hood-Odell Process

The Hood-Odell process, designed by O. P. Hood, chief mechanical engineer of the United States Bureau of Mines, and his assistant engineer, W. W. Odell, is described in a recent bulletin No. 2441 issued by the Bureau, which characterizes it as an attempt to accomplish the carbonization of lignite by simple and cheap methods within reach of the financial means of the small producer of lignite. In its present state it does not recover by-products. It was first demonstrated at the University of North Dakota, Grand Forks, N. D., at the joint expense of the United States and the University.

This unit, which is rated at about ten tons of raw lignite per day, consisted of a single retort or kiln about 6 feet long, 10 feet high, and three feet wide at the widest point with contractions at the bottom, at a point about one-third the way up from the bottom, and again about one-third down from the top. These contractions divide the shaft into three zones, each having tapered sides, and serve to give a turning motion to the lignite on its way downward, as well as to permit the penetration of the air.

Lignite in lump form is charged into the open top and flows downward, while hot products of combustion pass upward through it and out at the top. Part of the lignite, and the greater portion of the gases of distillation, are burned in the lower and middle zones by jets of air entering the shaft through openings provided just below the contracted throats. The product is a fine char, containing a small quantity of burned lignite and having the usual high ash content peculiar to carbonized lignite.

Although the Bureau is interesting itself in the question of burning this char in its natural state (about the size of granulated sugar) it is the Bureau's opinion that the best market can be found for it in briquetted form or as pulverized fuel.

The Zwillinger Oven

A coke oven, invented by B. Zwillinger, offers a combination of the principles of the coke oven and of low temperature carbonization. It has never been built in the United States but it is offered to the industry by a group of New York men. The oven consists of a low chamber about 7 feet wide and 30 feet long, in which coal is charged to a depth of 24 inches. It is heated from combustion

flues in the floor and all heat travels upward through the coal, while the distillation gas leaves the coal from the upper side and is not degraded by contact with the heated surface. The tars to be obtained from an oven of this kind should be of lighter nature and in larger quantity than those from the regular by product oven; but the quality of the coke probably would not be as good, particularly that from the top of the charge.

Marshall Process (British)

The Marshall process, also called the Marshall-Easton process, is the successor to the Neilson, sometimes called the LMN process, and is the invention of F. D. Marshall, Consulting Gas Engineer, of London. It is offered to the gas industry in this country by the engineering firm of Hone, Cryder & Webb, 17 East 42nd St., New York. No plants have been built in the United States but a small demonstration unit is said to be in successful operation in England.

The process may be termed a combination continuous retort and water gas generator, having an excellent thermal efficiency and producing a gas which may be varied between 376 and 502 B.t.u. without carburetting with oil. The retort, illustrated in Figure 1, consists of a cast iron shell (1), about 7 feet high, containing a pair of overlapping screws (2), each about 15 inches diameter with screw flights 4½ inches deep; means for driving the screws at a speed of about 8 revolutions per hour; a coal charging device at the top and a coke discharging gate at the bottom. The iron shell is mounted within a brick setting and heated by hot gases from a water gas generator (3), the "blow" gases (4) passing around the shell and heating it externally, while the "make" gases (5), pass directly through the retort and mix with the distillation gas. Thus the retort is heated both externally and internally. Coal at the rate of about ten tons per day passes down through the retort on the screw flights. The inventor claims that the coal is not agitated or mixed by the turning motion, and that it is carbonized in about three hours, being discharged in two streams of coke, one from each screw. A portion of the coke is charged in the water gas machine, the amount being regulated so as to control the heat value of the mixed gas leaving the retort; the balance, or one-half to three-quarters of the total, is available for marketing.

Everard Davies Process (British)

This system of vertical retorts, offered by Wm. Everard Davies & Co. Ltd., London, appears to have reached only the paper stage, for no mention is made in the published matter of a demonstration plant or a commercial installation. The retort consists of a vertical chamber about 18 inches wide, 15 feet long, and 17 feet high, which together with other similar chambers is set into the usual battery formation. One wall of the chamber is used as a gas outlet duct, being perforated and fitted with means for removing the gas at the top; the other wall is used for heating purposes, and is provided with vertical flues of triangular cross section, set with their bases to the oven face, and equipped with gas burners arranged in two zones, an upper and a lower. Between the heating flues are triangular conduit flues set with their apexes to the oven faces, from which openings lead into the oven, serving to conduct hot gas—preheating it at the same time—into the oven chamber for internal heating of the charge. This system combines, the inventor claims, all the benefits of internal heating methods with the advantages of high temperature external heating, and at

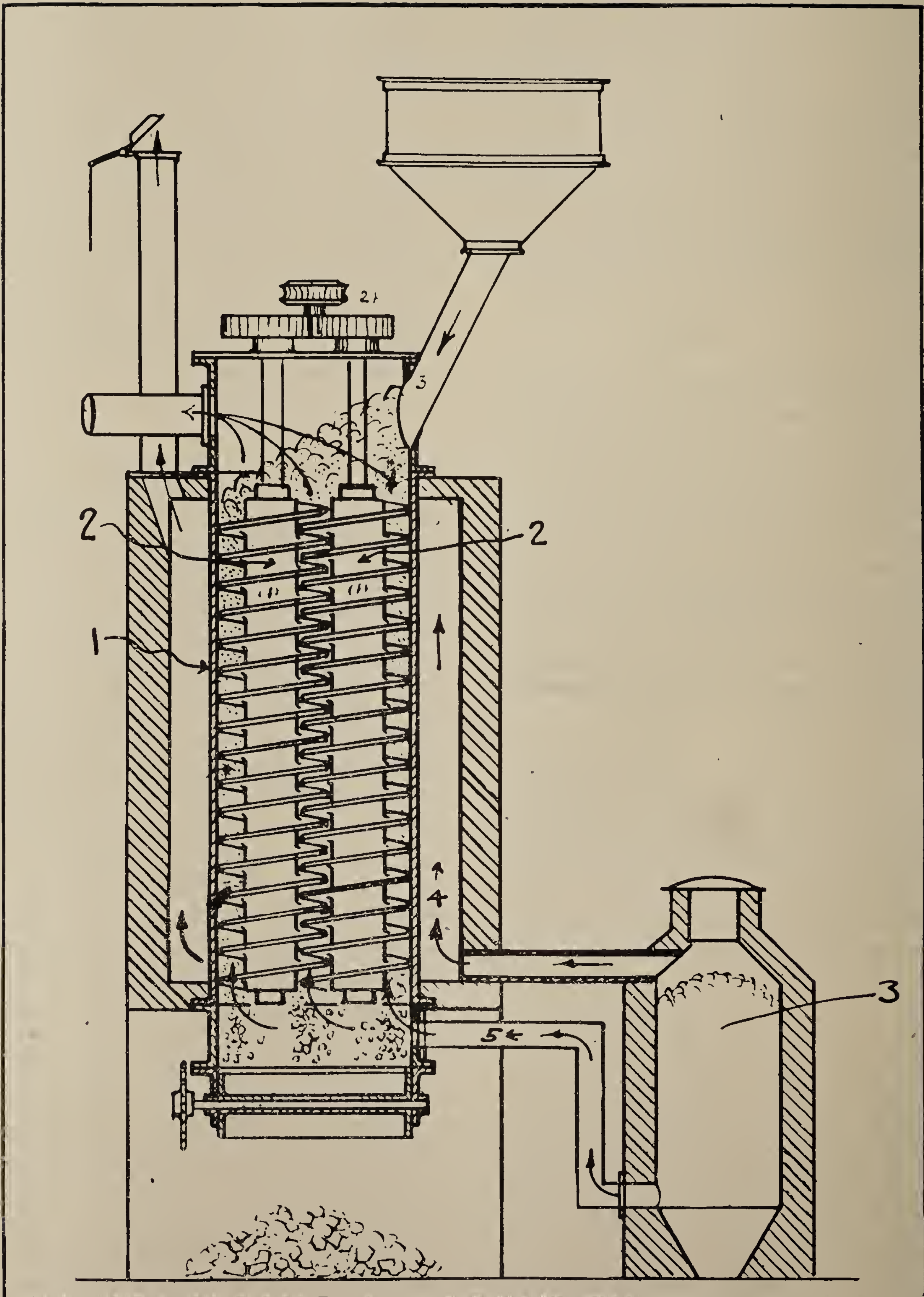


Fig. 1

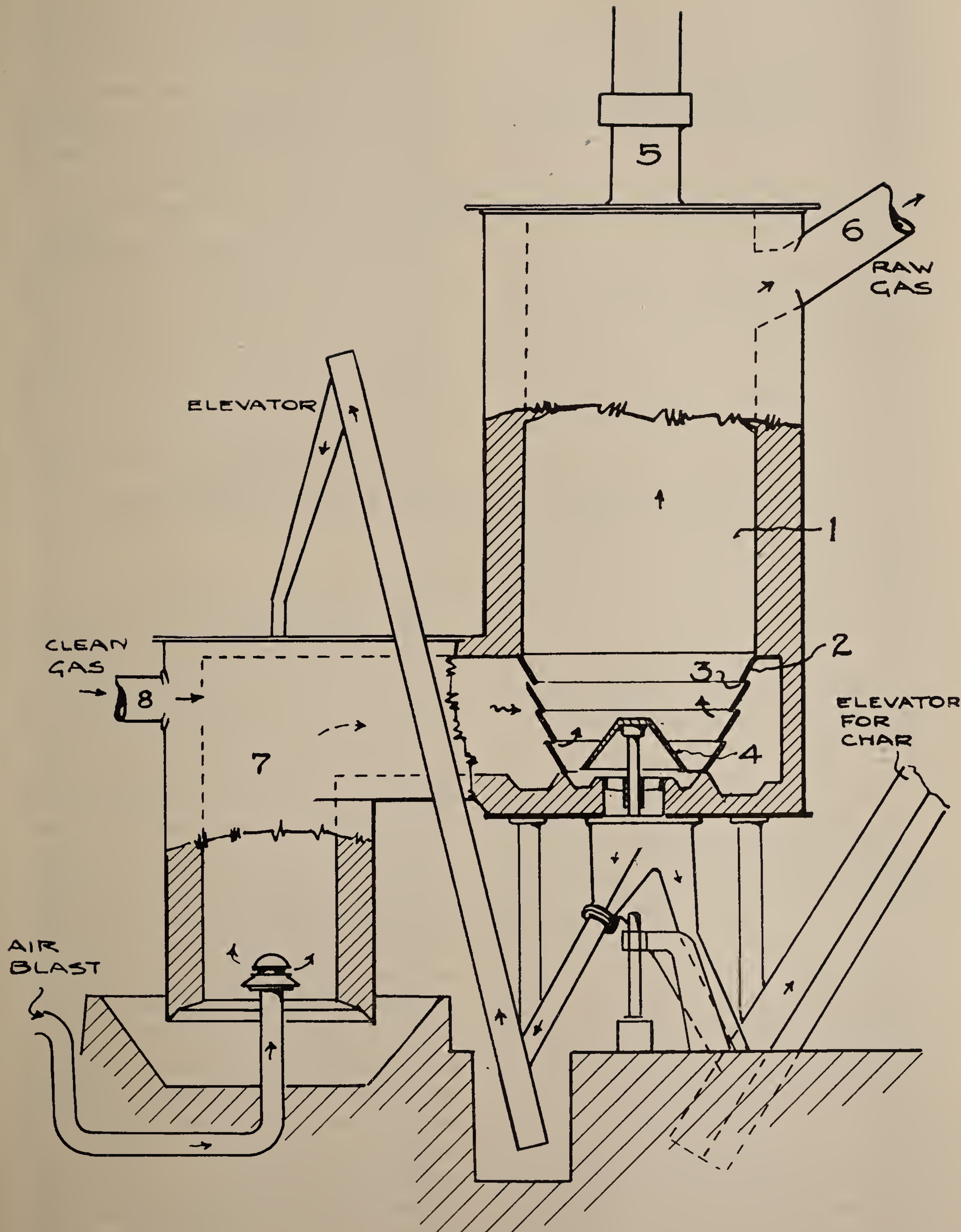

5
6
RAW GAS
ELEVATOR
1
CLEAN GAS
8
7
2
3
4
ELEVATOR FOR CHAR
AIR BLAST

Fig. 2

the same time yields by-products comparable to the best obtained by the low temperature process.

A more detailed description, with illustrations showing this process, may be found in "Industrial India," February 1923.

Woodall, Duckham and Jones, Lead Bath Process

In a paper read before the Coke Oven Managers' Association (British) J. Stanley Morgan told of a process sponsored by Messrs. Woodall, Duckham and Jones which he described as a "lead bath method." His reported remarks referred more to the wonderful results to be obtained from such process than to methods or apparatus. Evidently it is the intention of the inventors to immerse powdered coal directly in a bath of molten lead, but unfortunately it is not stated how this is to be done; what the effect of such procedure would be; what the apparatus would look like and whether it has been tried on larger than laboratory scale.

The Fabian Process (German)

Of the various processes mentioned from time to time in the German technical press, the Fabian process, built and operated by the General Gas Co., Berlin, Mr. Fabian, Chief Engineer, seems to be unique and it promises to be the most interesting development of the year to those who are concerned with the processing of non-coking coal or lignite. The apparatus shown in Figure 2 consists of a cylindrical shaft (1), similar to a gas producer, with a tapering metal hopper (2) at the bottom, in which are openings (3) for admitting a heating gas into the chamber; a revolving discharge device (4) for removing char; a coal inlet (5); gas outlet (6); an auxiliary combustion chamber (7) in which part of the char is burned to furnish heat for the carbonization; and a return gas line (8) leading to the combustion chamber. When in operation the shaft is full of coal; coke or char is burned in the combustion chambers, and the products of combustion from this, as well as from the gas burned at (8), pass into the shaft and rise through the coal and carbonize it.

The gas passes to the condensing apparatus and is cleaned of its tar. The temperature of distillation may be closely controlled by regulating the blast to the combustion chamber, or the gas flame above it. By reason of its close control this process appears to offer a solution to one of the main difficulties found heretofore in processes of its class and we expect to hear more from it.

The Fusion Retort (British)

The "Fusion" Rotary Retort, (Hutchins' Patent), is owned by the Fusion Corporation Limited, an English firm. It has been built in a demonstration plant at Cledford, Cheshire, England, where tests are made on samples sent by prospective clients. The retort was developed for the distillation of oil shales, and the like, but is said to be applicable also to lignites and coals. The apparatus consists of a revolving drum, set within a brick tunnel and heated externally by gas. It has the usual coal feed and coke withdrawing devices and a novel stuffing box for maintaining a tight joint between the shell and the end casting. The principal novelty of the system lies in the use of a tumbling member consisting of short plates set at right angles, in star fashion, along a rod which extends lengthwise of the retort; the whole device tumbling around with the retort when it revolves. This, it is claimed, will break loose any deposits which may collect on the shell.

In conclusion, we wish to repeat that these brief descriptions do not attempt to cover the field of low temperature carbonization. Those processes which are of historical interest, and those which have gone no farther than the patent office, are purposely omitted. Readers wishing information on English and German processes are referred to "Low Temperature Carbonization of Coal," a series of papers read before the South Wales Institute of Engineers, April 20, 1922, and "Neue und alte Wege der Braunkohlen-und Schiefer-Verschwelung."

The writer wishes to acknowledge his indebtedness to Professor Harry A. Curtis; and to Messrs. J. D. Davis, of the Bureau of Mines; A. W. Warner, of the American Gas Company; Lesslie R. Thomson, of the Lignite Utilization Board, and James Melville of the firm of Coverdale and Colpitts for their assistance in connection with this report.

SOME OBSERVATIONS ON THE MIXING OF COALS FOR CARBONIZATION*

By Joseph D. Davis[1]

Introduction

For a number of years it has been considered good coke-works practice to mix coals of high-volatile matter content with low-volatile coals in order to secure cokes of dense structure suitable for blast-furnace use. A further object may be to decrease the sulphur content, particularly in this country where the high-volatile coal sometimes runs high in sulphur, and where low sulphur low-volatile coals are available for mixing therewith. The amount of volatile matter required in a good by-product coal is from 25 to 33 per cent, and it is a fact that there are few seams of coal in this country that fill this requirement, due consideration being given to sulphur and ash content. Where the practice of mixing coals is resorted to, the range of volatile matter may be extended to include coals running from 17 to 38 per cent, thus admitting a large number of coals into the by-product class which otherwise would not yield good coke. The chemical qualifications for a coal suitable for by-product coking are given in the Keystone Coal Catalog[2] as follows:

Volatile matter	17 to 38 per cent
Ash	4 to 8 per cent
Sulphur	Under 1½ per cent
Phosphorus	0.02 per cent

These figures are based on actual by-product coking practice, and may doubtless be taken as authoritative. This might not apply to foreign coals, however, since nothing is stipulated as to the quality of the volatile matter, which is indeed an

*Published by permission of the Director, Bureau of Mines, Department of the Interior.
[1]Fuels chemist, Bureau of Mines.
[2]Keystone Coal Catalog for 1922, p. 220. Keystone Consolidated Publishing Co., Pittsburgh, Pa.

important factor, as will be shown further on where it is evident that the quantity criterion serves well for classes of American coals so far coked, so one is not justified in assuming that is general.

In so far as gas-making properties are concerned, there is probably little to be gained by mixing coals. Here the main requirements are that the coal shall yield the maximum percentage of its calorific value in the form of gas, and that the coke produced shall be of marketable quality. American coals of volatile content 35 to 38 per cent which have less than 1.25% sulphur and not more than 8 per cent ash are in general considered the best gas coals. The higher the volatile matter within this range the better the gas yield. Coals running over 38 per cent volatile matter are usually high in oxygen and low in available hydrogen, and hence yield a poor gas. They would not serve to mix with low-volatile coals for the purpose of adjusting the volatile matter content as in the case of by-product coking, since the gas yield would suffer thereby. It is clear that for gas-making purposes the quality of the volatile matter is of prime importance. An English criterion of quality is the oxygen-hydrogen ratio in the coal substance. This should approximate the ratio.

$$\frac{\text{Oxygen}}{\text{Hydrogen}} = 2.0$$

Another criterion which has been proposed is the calorific value of the volatile matter, which it is claimed should approximate 150 B.t.u. per cent of volatile matter present. Clearly this is equivalent to stating that the content of available hydrogen should be a maximum. It is required, then, for gas making, that the quantity of volatile matter be high, that the make be high, and that it be rich and that a rich gas be produced. A further quite obvious requirement is that the coal give up its volatile matter quickly, and that the maximum throughput may be secured with minimum outlay in carbonizing equipment.

The Coking Principle

A great deal of research work has been done with the object in view of elucidating the nature of the coking process. Answers have been sought to the questions: (1) why does coal coke? (2) what constituent or group of constituents cause cementation of the heated coal mass? (3) how can one measure the comparative coking power of coals? (4) on what property or properties of the coke-forming constituents does the coke quality depend? Considerable progress has been made toward answers to these questions during the last ten years, but the complete solution of the problem of what causes coking has not yet been obtained. Since the intelligent blending of coals must be based on a knowledge of the coking constituents and some precise measure of their comparative coking power, the object of this paper will be to consider briefly what has been learned on the subject so far, and to draw such general conclusions as may seem justified as to guiding principles. Heretofore, the proper blends to use in coking have been determined largely by direct trial on a commercial scale.

The Proximate and Ultimate Analysis

As indicated above, the usual coal analysis is inadequate to fix the coking power of a coal. The volatile-matter content is perhaps the most valuable indication; but this is a measure of total volatile, including that which contributes to the coking properties and all other volatile matter as well. It is thus not

even an exact quantity measure of the coking principle, and is useless as a quality measure. Of two coals containing the same quantity of volatile matter, one may produce a fair coke and the other none at all. The amount of oxygen given by the ultimate analysis is of value, since it has been found by experience that coals containing more than 10 per cent oxygen do not produce a good coke. The amount of available hydrogen a coal contains (total hydrogen—⅛ total oxygen) is also indicative of coking power, as is the ratio of fixed carbon to volatile matter. The calorific value of coal substance is to a certain extent a measure of the richness of the volatile matter; but this and other criteria given by the usual analysis give us no information as to the nature and properties of the coking principle, hence they must be used with caution in estimating the coking properties of coals.

The Action of Solvents

Work on the action of solvents on coal originally had for its object the determination of the chemical structure of the coal substance; and while little progress has been made toward the solution of this problem, recent research has shed considerable light on the nature of coal constituents which cause coking, particularly the action of the heavier solvents such as pyridine and phenol. These solvents are among the most effective as to quantity of coal substance dissolved, probably, as has been suggested, because they depolymerize the volatile matter of the coal. The solutions (probably colloidal) obtained are mixtures of compounds of which the chemical structure has not been determined. It has been shown, however, that they do contain the active cementing principle of the coal.

Professor P. P. Bedson was the first to note the vigorous action of pyridine on coal, and at his suggestion P. Baker investigated its solvent power on various English coals. Thus a Durham gas coal yielded 20.4 per cent extractable matter, and a Durham coking coal 11.5 per cent. A New Zealand brown coal yielded 5.65 per cent. The work is reported in the Journal of the Society of Chemical Industry for 1902, on page 241.

R. V. Wheeler[3] and his associates found that the pyridine soluble extracted could be further separated into substances soluble in chloroform and those insoluble in that solvent. These writers claimed by the extraction process to have effected a practically complete separation of cellulosic degradation products from the so-called "resinic" constituents of the coal. To the constituents of coal thus separated the following names have been given:

Insoluble in pyridine . . (alpha) cellulosic
Soluble in pyridine, but insoluble in chloroform (beta) cellulosic
Soluble in both chloroform and pyridine (gamma) or "resinic" compound.

Each class doubtless includes a large number of chemical compounds, and the names must be taken as only roughly indicative of their nature. The writer is inclined to believe that the name "aromatic asphalts" suggested by Marcusson[4] more accurately characterizes the compounds than the term "resins."

Leaving, however, the question of the chemical composition of coal constituents so found, it will suffice to note the bearing of this work on the coking power of coal. It has been shown that the alpha and beta compounds do not coke when

[3]Wheeler, R. V. and Burgess, M. J., The Volatile Constituents of Coal, Jour. Chem. Soc., vol. 99, 1911, p. 649. Clarke and Wheeler, ibid, vol. 103, 1913, p. 1704.
[4]Marcusson, J., The Resinous Constituents of Coal, Z. Angen. Chem., 321, 1919, p. 385.

carbonized alone, and that the gamma compounds are active in cementing the whole into coke on carbonization. Parr[5] has reached the same conclusion as regards the phenol extractable of coal and the residue. The residue will not coke, whereas the extract will. Furthermore, when residue and extract are mixed in the original proportions and carbonized, a coherent coke results.

Quite recently, Illingworth[6] has investigated the action of pyridine and chloroform on coal, with particular reference to its coking properties. He has gone further than previous investigators in that he has shown that the decomposition ranges of the various constituents, particularly the resinic, have a bearing on the quality of the coke produced. Coke formation then—that is, the formation of a satisfactory coke—will depend not only upon the quantity of cementing principle present, but also upon the heat-treating method, which should be regulated to accord with the quantity and nature as well as the constituents present. This seems a rational method of attack on the coking problem, and undoubtedly represents a valuable contribution to our knowledge of the subject; it must be recognized, however, that there remain many variable factors to be investigated before a complete solution can be claimed. Obviously, the end sought is that given coals, which in themselves do not produce a satisfactory coke, one may determine by analysis what proportions of other available coals to add to secure a good coke.

Agglutinating or Coking Power

From time to time various empirical methods have been developed which have had the object in view of comparing by direct experiment the relative power of various coals to form coherent cokes. The general procedure is to heat the coal under carefully regulated conditions mixed with various amounts of an inert substance (the maximum amount of inert a coal will take and still produce a coherent coke is taken as a measure of its coking power). A method recently proposed by Sinnatt and Grounds[7] will serve to illustrate the principle:

In accordance with this method, a 1-gram sample of the coal to be tested is mixed with carefully sized electrode carbon, and is coked exactly as in the method for volatile matter recommended by the American Chemical Society. The coal is all ground to pass 90 mesh, and the gas carbon (inert) is sized to pass 60 mesh and remain on 90 mesh. A series of tests are made with increasing amounts of inert until the coke button will just fail to sustain a 100-gram weight. The maximum amount of inert which a coal will carry and still sustain the weight is taken as a measure of its agglutinating power. The writers observe that the size of the inert used has a pronounced effect on the results obtained, and show that the determining factor is not the volume of inert, but the surface exposed—that is to say, the more surface exposed the less the agglutinating power. This seems reasonable if one may use the analogy of the cementing power of binder in briquetting practice. Here a fine coal within certain limits will take more binder than a coarser coal, and the best practice, in so far as economy of binder is concerned, is to have a graduation of sizes so as to secure a maximum

[5]Parr, S. W., and Hadley, H. F., The Analysis of Coal with Phenol as a Solvent. Bulletin No. 76, Illinois Engineering Experiment Station, 1914, 41 pp.

[6]Illingworth, S. Roy, Researches on Coal. I. The thermal decomposition of coal at low temperatures. II. An investigation of certain coking coals: A theory of coking. J. Soc. Chem. Ind., vol. 39. 1920, pages 111-18 and 133-38.

[7]Sinnatt, F. S. and Grounds, A., A New Characteristic of Coal: The Agglutinating Power. J. Soc. Chem. Ind., vol. 39, 1920, p. 83T.

interlocking effect of particles. It may be pertinent to observe further that in briquetting a porous material, such as coke, it will take an excessive amount of binder. Therefore, in the carbonization of coal in which the alpha and beta constituents are more or less porous, one would expect considerable amounts of the coking constituents to be absorbed during the same plastic coking stage, and thus be rendered ineffective as a cement. Obviously, when it comes to making use of this test as a guide in mixing coals, or as a method of determining their suitability for coking, it is open to the objection that the heating conditions maintained do not even closely approximate those of a commercial coke-oven. This objection may, in fact, be raised against any laboratory scale coking carbonization test. The writer believes, however, that the agglutinating power as above defined may prove of considerable value if supplemented by some such test as the so-called Dutch oven coking test.

The Plastic State

At a temperature somewhere between 350° and 450°C., coal being carbonized assumes a plastic or semi-plastic state. At this point the mass occupies minimum volume, and when the temperature rises there is excessive decomposition attended by swelling of the charge. At the point of completion of the coking or cementation the charge contracts again. The temperature ranges within which these phenomena take place, and the nature of the changes themselves depend, according to Illingworth,[8] on the nature of the coal treated.

The heat treatment of the coal during the plastic state may well be expected to exert a strong influence on the coke. Thus, if the heating is too rapid, the bubbles of escaping vapors will distend the mass excessively, the bubble walls will be carbonized or "set," and a spongy coke will result. Parr[9] has developed a method for investigating the plastic state of coal which consists in slowly heating the coal in an enclosed space while passing a current of nitrogen through it. The plastic state is indicated by stoppage of the flow of nitrogen and consequent development of "back-pressure," which is measured. As soon as the plastic state is passed, and coke begins to form, the gas again passes through the charge. A time-pressure curve gives a picture of the passage of the coke through the successive stages. The effect of various heating rates can be studied by this method, and it should be well adapted to the study of that phase of the coking problem. In this connection it is pertinent to maintain a principle enunciated by Parr[10] at an earlier date anent the plastic state which is as follows:

"The formation of coke depends on the presence of certain constituents having a melting point which is lower than the temperature at which decomposition or carbonization takes place."

Synthetic Coke[11] *a Possible Ideal*

Having considered briefly the latest theories on the coking process, it may be well to look to the evidence accumulated in practice as demonstrating the practicability of synthesizing coke or modifying its properties as by mixing. A few examples will serve to illustrate what has been learned so far.

[8]Loc. cit.
[9]Parr, S. W., Paper read at the convention of the American Chemical Society, September, 1922.
[10]Parr, S. W. and Olin, H. L., The coking of coal at low temperatures with special reference to the properties and composition of the products. Bulletin 79, University of Illinois Engineering Experiment Station, 1915, 39 pp.
[11]Applied here to any coke made by suitable blending of non-coking or poorly coking carbonaceous inerts with fusible binder.

The final product of the well-known carbocoal process is really a synthetic coke. It is made by briquetting a low-temperature coke with sufficient pitch binder and carbonizing the briquet at high temperatures. The result is a very dense coke of absolutely uniform size. So far, carbocoal has had somewhat limited use, but the writer is informed that it is an excellent fuel, superior in some respects to anthracite coal—that it has even commanded a higher price than anthracite for domestic use. Apparently, it has not been tried out as a metallurgical coke, but it would seem to possess the required characteristics in so far as these may be defined from present knowledge of the requirements. Suffice it to say that there is considerable latitude for variation of the product by varying the method of manufacture—that is, amount of binder, fineness of first stage product, manner of briquetting, etc.,—and it seems very reasonable to assume the possibility of making a coke of almost any desired properties. Unfortunately, there is no reliable method of defining metallurgical coke other than by its method of manufacture from known materials; hence the uncertainty as to the suitability of such products as carbocoal. Obviously, more research is needed to show just what properties are required of metallurgical coke. Then one might proceed intelligently to build up a synthetic coke to specifications. It might even be possible to so modify gas-works coke as to bring it within these specifications.

Some years ago Parr[12] demonstrated that it is entirely practical to reduce the plasticity of high-volatile coals by admixture of coke, thus avoiding an excessively porous final product. He says: "This material, acting in the capacity of a 'blotter,' reduces the plasticity of the softened mass, and allows the gases to escape freely without producing a blowing effect." The carbocoal referred to above attains the same end—that is, the required plasticity of the coking mass—by the converse procedure—that is, low plasticity is brought up by the addition of pitch. Some work done in the Bureau of Mines laboratory[13] indicates the possibility of making a coke from coals that normally will not coke at all by mixing with asphaltic-base oils.

Roberts[14] has reported success in blending English coals for the purpose of obviating swelling during low-temperature carbonization. He found that by proper admixture of a non-coking coal a dense, hard coal, which will not give trouble from undue expansion in the low-temperature retort, can be produced.

Tulpholme,[15] referring to the Davies process in a recent article, avers that "the raw materials best amenable to low-temperature treatment from the point of view of maximum yields of oils and tars—the determining product factors—comprise the high-volatile coals of semi-coking varieties and the cannels and lignites; it will be realized that this composition blend is usually abnormal or extreme along the cellulosic and proteid groups. Mixing of high-coking and non-coking blends to realize a balanced low-coking composition is desirable."

We might cite numerous other instances to show the technical practicability of blending coals or mixing inert carbonace-

[12] Parr, S. N. and Olin, H. L., loc. cit.
[13] Davis, Jos. D. and Coleman, C. E., Low Temperature Carbonization of Amalgams of Non-Coking Coals and Asphaltic Oils. Chem. & Met. Eng., vol. 26, p. 173.
[14] Roberts, John, Economic Aspects of Low Temperature Carbonization. Proc. South Wales Inst. of Engrs., vol. 38, p. 190, May 16, 1922.
[15] Tulpholme, C. H. S., Great Britain Points the Way in Low Temperature Carbonization. Chem. & Met. Eng., vol. 29, p. 142, July 23, 1923.

ous material with binders to produce coke, but the above are perhaps sufficient to prove the principle. The economic aspects of the question present a specific problem to which more attention must be given. In synthesizing coke from low-grade or low-rank materials, one must keep in mind the competition of raw materials now available which will produce the desired coke by direct and well-developed processes. For the present it seems doubtful that synthetic cokes will compete, particularly where much modification of present processes is entailed. However, when the present supply of good coking coal is depleted, industrial development of synthetic coke may be expected.

BUILDERS' SECTION

W. E. STEINWEDELL, *Chairman*
Cleveland, Ohio

REPORTS SUBMITTED BY
MANUFACTURERS OF CARBONIZING
APPARATUS

CARBONIZING APPARATUS OF THE GAS MACHINERY CO.

W. E. Steinwedell, Cleveland, Ohio

During the last year The Gas Machinery Company furnished twenty-four three-ton by-product gas ovens in the gas plant at Evansville, Indiana, the front of which ovens are shown by Figure 1.

Primary and secondary air are forced into the setting by means of a fan blower and the amount of primary and secondary air admitted is controlled by blast gates.

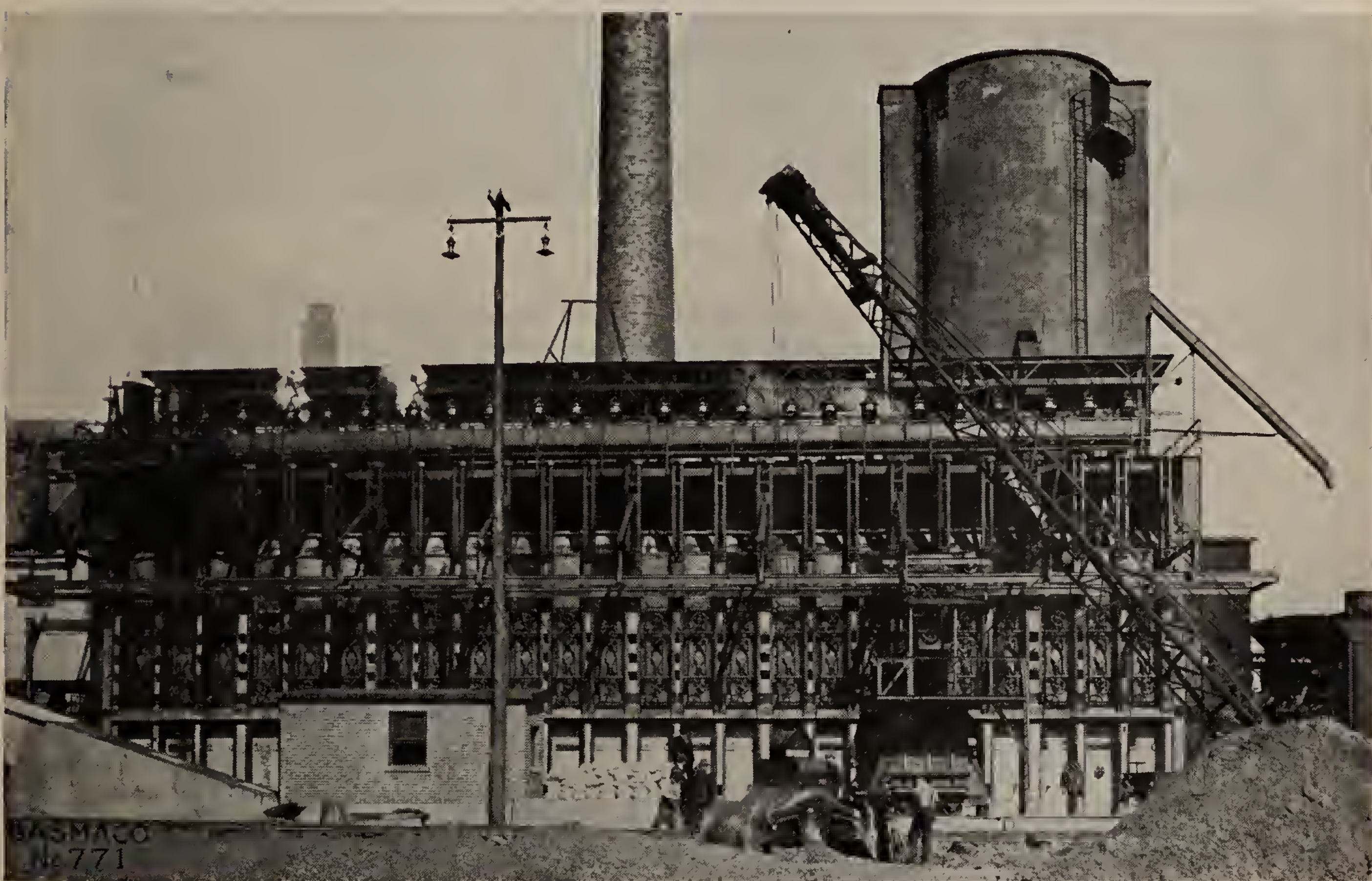


Fig. 1

The ovens are built in units of three, which are heated by a producer of the extended type, provided with a centrally located charging door, thus permitting the fuel to be charged by gravity from a fuel car which runs on an industrial track.

Each setting of three ovens contains two secondary and one primary recuperators.

Each secondary recuperator is divided into four sections for accurate control of heats from outside of the setting.

Fig. 2

Fig. 3

The exhaust steam from the fan is admitted with the primary air through the primary air recuperator to maintain proper fuel bed conditions, prevent the formation of excessive clinker and insure a uniform production of producer gas.

The general view of the plant is shown by Figure 2, the coal handling equipment being shown on the right and the locomotive crane and coke handling equipment on the left.

A particular feature of these ovens is the self-sealing flexible doors shown by Figure 3.

These doors have stood the test of time, are of minimum weight, easily handled and adjusted and are self-sealing metal to metal. The photograph was taken when the ovens were in operation.

A liquor circulating system with separator and tar displacement tanks insure clean liquor for circulation, thereby preventing stoppages of liquor piping and pitch formation.

Carbonizing coal in greater bulk than is possible in retorts is very desirable in plants of medium and larger size.

By-product gas ovens as installed at Evansville allow the selling of all the gas made, are heated by part of the coke produced which fuel is burned in generators attached to the ovens as in Evansville or by isolated mechanically stoked producers.

The secondary air is also preheated by the waste gases and burns the producer gas formed in the generators or producers.

By-product gas ovens are adaptable to any size of plant selling more than about 375,000 cu. ft. per 24 hours and are built in units of about 375,000 cu. ft. to 5,000,000 cu. ft. capacity per 24 hours.

The ovens are built in sizes of about two-ton, four-ton or seven-ton capacity.

CARBONIZING APPARATUS OF THE IMPROVED EQUIPMENT CO.

F. G. Curfman, New York, N. Y.

During the year of 1923, considerable interest was shown by the gas industry in the developments made in the horizontal gas ovens and a number of contracts for this type of equipment were awarded. The Improved Equipment Company was among the first to build the horizontal gas oven and continued satisfactory results obtained from their early installations does not warrant many changes.

A contract has been awarded The Improved Equipment Company for the erection of a complete new carbonizing plant for the Danbury & Bethel Gas & Electric Company, Danbury, Conn. The initial installation will consist of

12 ovens arranged in units of three ovens each, each unit having its own separate producer. The ovens will be 12″ wide, 8′ high and 13′6″ overall in length. The general construction will be very similar to that of the ovens built by The Improved Equipment Company in Pontiac, Jackson, and Ann Arbor, Michigan.

top of the ovens in a similar manner to the other plants installed by The Improved Equipment Company. The door extracting device will be operated entirely by the ram in place of being made separate as in former installations. This is a decided improvement over the former design. The coke will be discharged on to a quenching wharf which

Horizontal Oven Plant Showing Roof over Ovens and Storage Bins for the Coal and Producer Fuel.

The principal improvements to be made will be in the design of the pusher and the apparatus for handling the coal and quenching coke. The coal will be received in a track hopper, elevated by means of a skip hoist into the overhead storage bin. From the storage bin, it will be discharged into the coal larry which travels on a track over the

will be of sufficient capacity to hold the coke discharged during the night shifts so that all coke could be handled to storage during the day. Track scales will be provided for weighing the coal and producer fuel.

The ovens will be protected by an asbestos roof covering, there being no

sides or ends to the oven shelter. Each oven will receive a 4,000 pound charge of coal, which will be carbonized on 12 hour periods. The labor schedule of the carbonizing plant is as follows:

Labor Schedule

Carbonizing 50 tons—24 hours. Shifts—8 hours each.

Doherty washer cooler, exhauster, P. & A. tar extractor, secondary washers, oxide purifiers, meter and from there to the holder. It is the intention to operate this carbonizing plant in conjunction with the present water gas plant. Both gases to be stored in a common holder but metered separately.

Front of Horizontal Oven Plant Showing Producers and Pushing Machines.

Carbonizing Labor

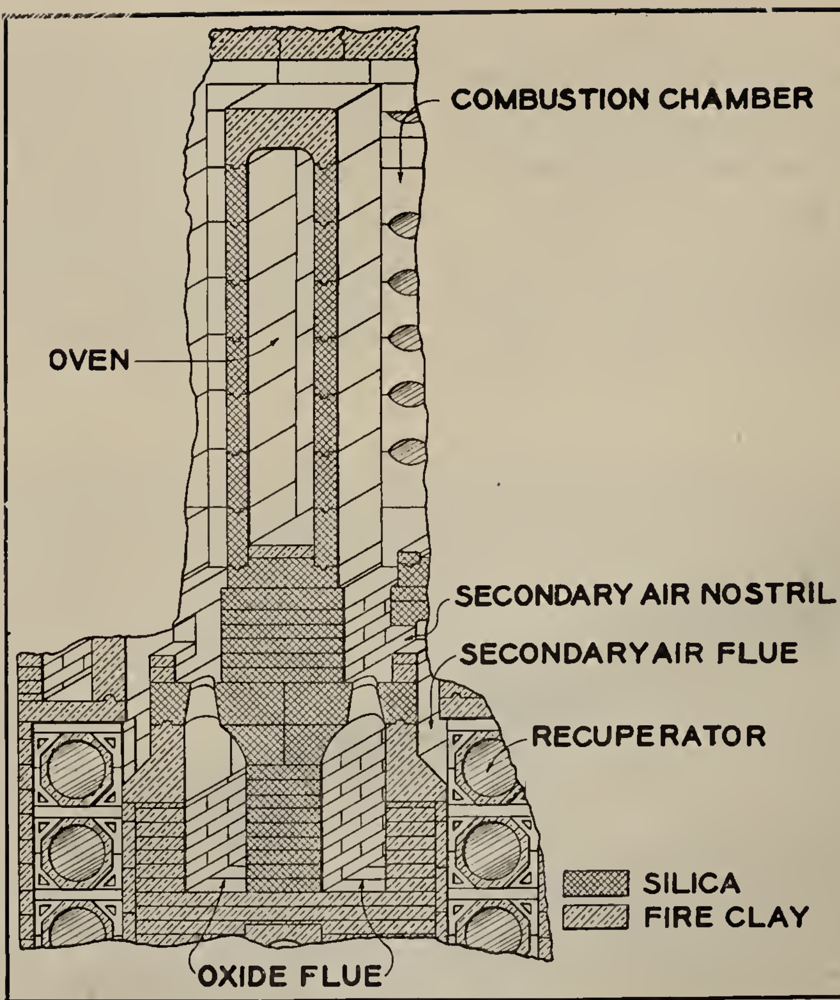
Men per shift	*Job*	*Man shifts*
1	Pusher Operator & Fireman	2 Shifts
1	Coal Larry Operator & Top Man	2 Shifts
1	Coke Car Operator & Quencher	2 Shifts
1	Fireman	1 Shift
4	To operate Ovens	7 Men Shifts

The same organization can carbonize 75 tons coal per 24 hours.

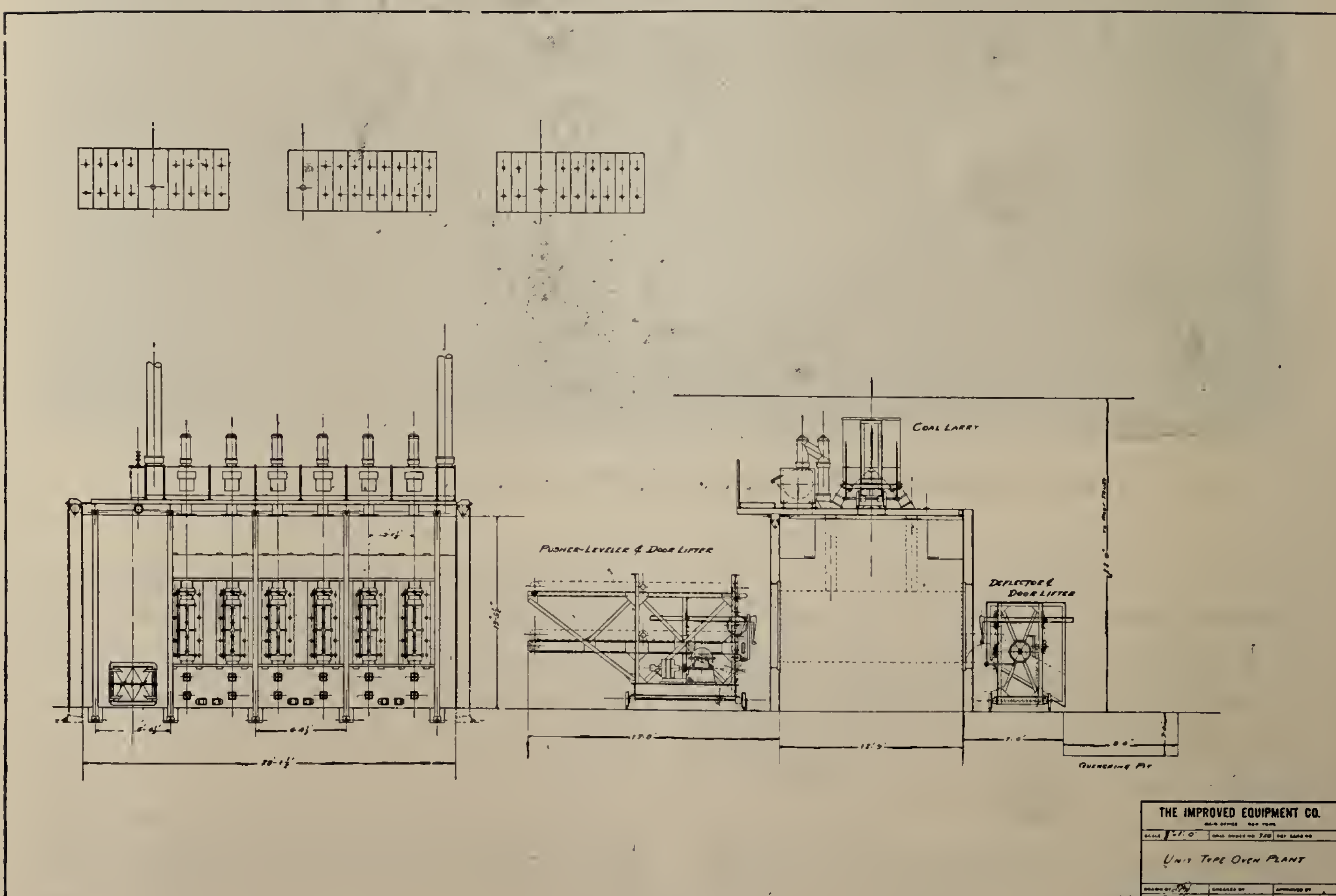
The gas on leaving the hydraulic mains will pass through a primary

Construction work will soon start on this plant and at the time of our next report, we will be able to give a more detailed description of the plant operation.

Another contract has been awarded The Improved Equipment Company for 12 additional ovens to be built in the


COMBUSTION CHAMBER
OVEN
SECONDARY AIR NOSTRIL
SECONDARY AIR FLUE
RECUPERATOR
SILICA
FIRE CLAY
OXIDE FLUE

No. 1


Coal Larry
Pusher-Leveler & Door Lifter
Deflector & Door Lifter
Quenching Pit
THE IMPROVED EQUIPMENT CO.
Unit Type Oven Plant

No. 2

plant of The Consumers Power Company, Pontiac, Michigan. The new ovens will be identical to our three former installations at this plant which have been described in our previous reports to the Carbonizing Committee. There has been no changes whatever in the design as the results obtained on the horizontal ovens at Pontiac are proving highly satisfactory.

In order to give the small gas plant (200 M per day or over) the advantages obtained on the horizontal gas ovens, The Improved Equipment Company has assembled their standard ovens in a continuous battery of three or more ovens as shown on the accompanying sketch of "The Unit Type Oven Plant." A double producer is built at one end of the battery of ovens, one producer carried as a spare and one producer heating the entire battery of ovens. The producer and ovens are charged on the same level on top of the battery. All operations are identical with the operations of the larger installations. Electrically operated coke pusher and door extractor and coke deflector or coke car and charging larry are provided. Such a plant will occupy a minimum of space and as all operations are mechanical they will produce a uniformity of coke as well as gas and by-products, which is difficult to obtain in a manually operated retort house.

Considerable work has been done by The Improved Equipment Company in perfecting the design of settings for standard retort benches. There continues to be a great demand for reconstruction and refilling work of standard retort benches in existing plants. The Improved Equipment Company has received a great many orders for equipping present installations with the Doherty Bench Fuel Economizer attached to their design of setting.

The use of inert or non-combustible gas in the combustion chamber of retort benches and carbonizing ovens to produce a long slow burning flame has given very satisfactory results and the application of the principals of the Doherty patents have made it possible to give an even heat distribution throughout the combustion chamber and positive control of the temperatures and at the same time obtain decided saving of the fuel consumption.

The burning of small sized unsalable coke mixed with low grade coal in the producers of the retort benches as well as the producers of the horizontal gas ovens have been giving very satisfactory results and The Doherty Bench Fuel Economizer makes it possible to utilize efficiently such fuels.

For the engineer who is considering the advisability of remodeling an existing retort house and reconstructing his benches, it may be useful to know where some of the modern types of retort benches can be seen. The latest application of The Doherty Bench Fuel Economizer on a few of the modern retort installations made by The Improved Equipment Company during 1923 can be seen in the following cities:

New York City, N. Y.—Through horizontal benches 9's—Retorts 21'0" long.

Inclined Benches 9's—Retorts 18'1½" long.

Through horizontal benches 6's—Retorts 21'0" long.

Yakima, Washington.—Through horizontal benches 6's—Retorts 11'0" long.

Spokane, Washington.—Through horizontal benches 6's—Retorts 10'0" long.

Colorado Springs, Colorado.—Through horizontal benches 6's—Retorts 10'0" long.

Macon, Georgia.—Through horizontal benches 6's—Retorts 11'5" long.

Lynn, Mass.—Inclined benches 9's—Retorts 18'1½" long.

DESCRIPTION OF THE KOPPERS COMPANY OVENS

Harold J. Rose, Pittsburgh, Pa.

The past year has been one of intense activity in the construction of by-product coke ovens. During this period the Koppers Company has completed, or has had under construction, ten by-product coke oven plants.

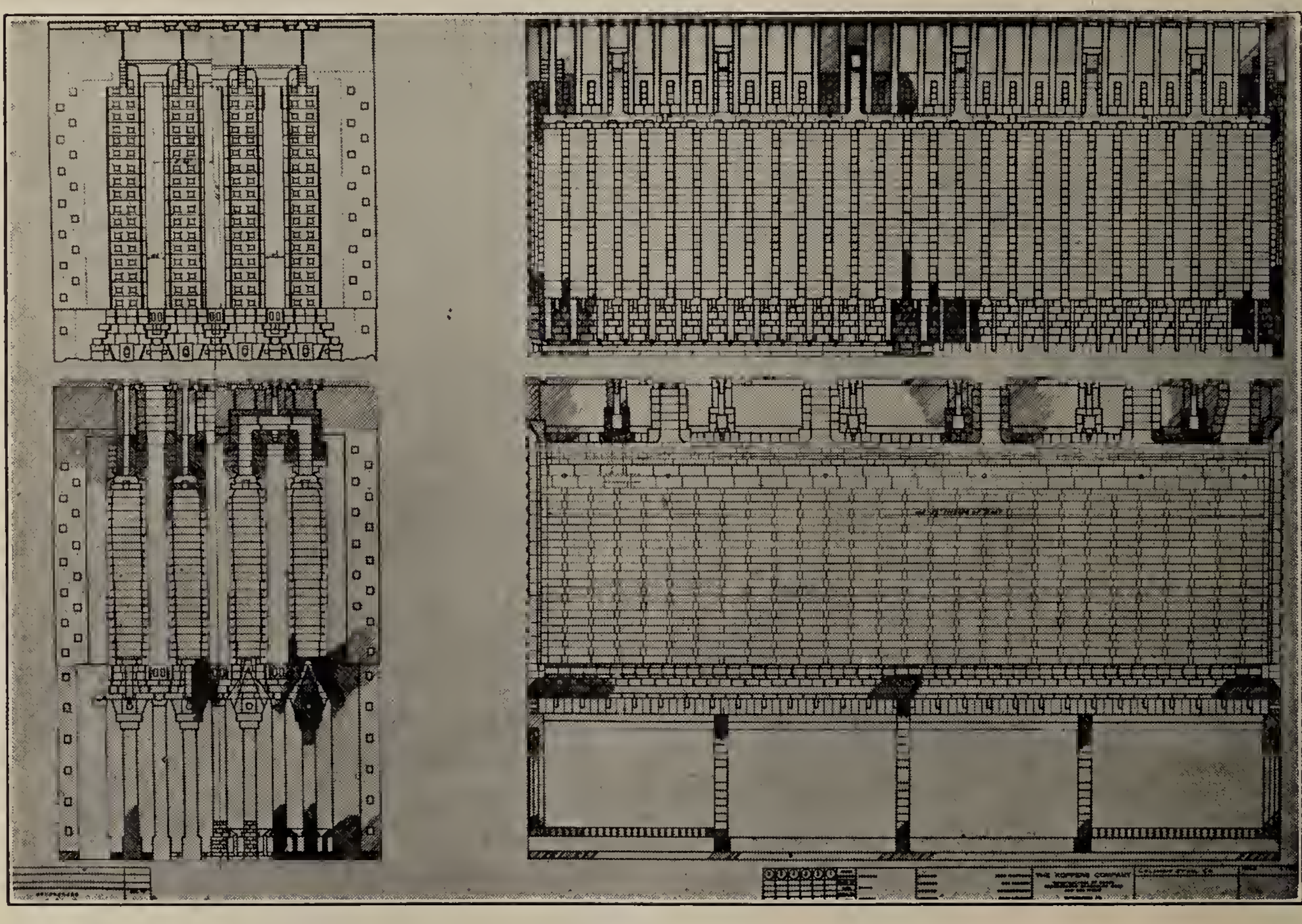


FIG. 1.

Becker Combination Coke and Gas Oven. Cross and Longitudinal Sections of Ovens now under Construction for the Columbia Steel Co., Provo, Utah.

The most outstanding feature of this period has been the widespread adoption of the new Becker coke and gas oven. Since the first battery of these ovens was completed at the plant of the Chicago By-Product Coke Co., eighteen months ago, every by-product coke oven plant contracted for in the United States, totalling fifteen batteries in all, with an annual carbonizing capacity in excess of six million tons of coal, has been of the Becker type. This forcefully bears out the prediction made a year ago that the Becker oven would dominate the field of by-product coke oven engineering. This development is of great importance to the gas industry, not only in its relation to the manufacture of gas in by-product coke ovens, but

also in its application to small gas ovens such as those which are now being constructed at Battle Creek and Zilwaukee, Michigan.

The performance of the Becker oven has attracted wide attention in Europe. Its construction in the British Empire (except Canada) will be undertaken by Woodall, Duckham and Jones (1920), Ltd., and in France, Belgium, Spain, Portugal, Italy, Luxembourg and the Sarre District by La Societe Anonyme de Carbonization et de Distillation des Combustibles, of Paris, which has for many years been active in the design and construction of by-product coke ovens.

In addition to the above coke-oven construction, The Koppers Company has completed or has had under construction, during the past year, twenty-four liquid purification plants with a capacity of two hundred seven million cubic feet of gas daily.

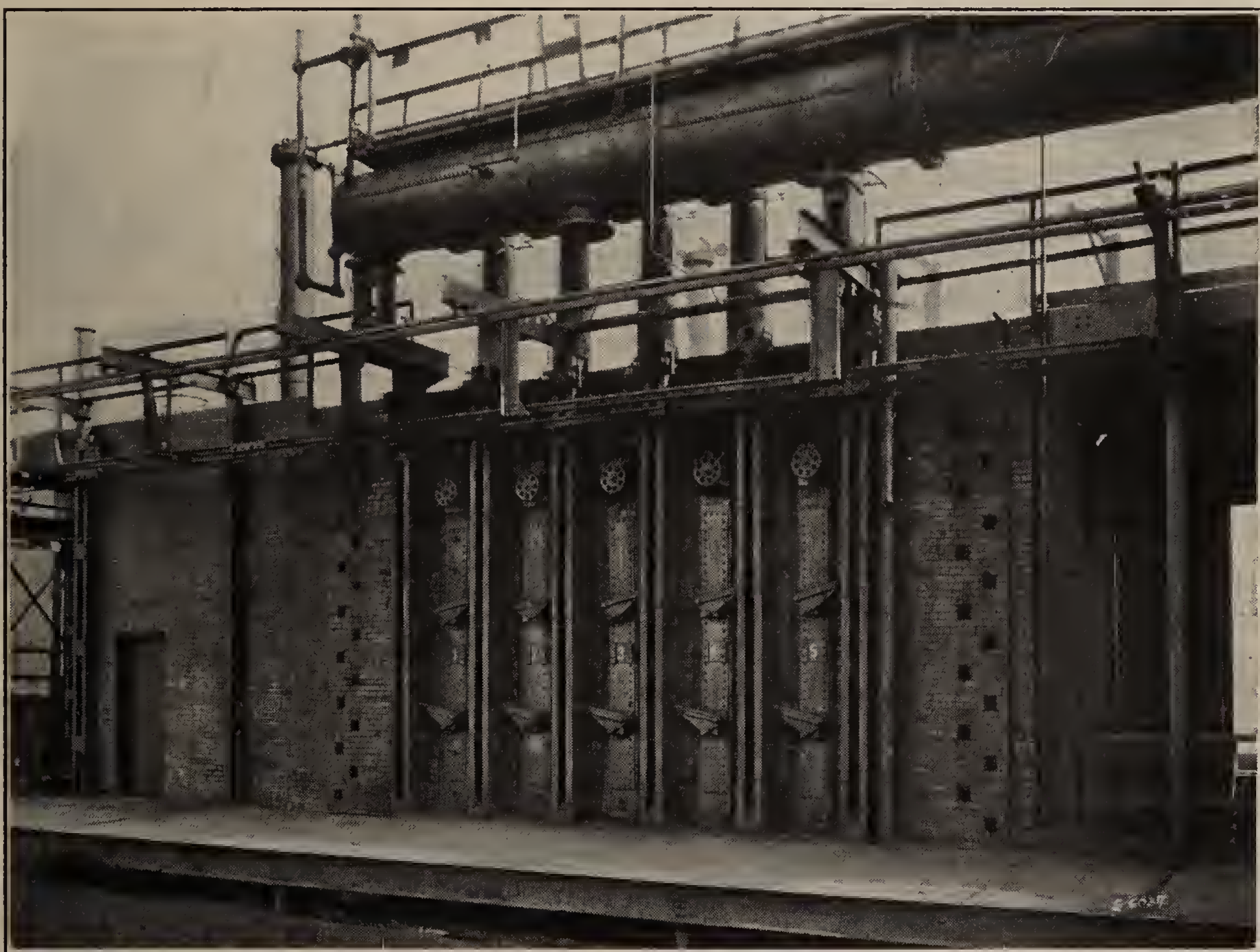


FIG. 2.

Battery of Five Becker Ovens. Plant of the Chicago By-Product Coke Co., Chicago, Ill.

THE BECKER OVEN

This oven was fully described in last year's report, and only a few additional features as employed in the latest design will be described at this time. Fig. 1 illustrates this oven as it is being built for the Columbia Steel Company.

Insulation of Ovens

A decided advance has been made in reducing the amount of heat lost by radiation. The latest ovens to be built have the ends completely protected by concealed built-in insulation, the cast iron

oven doors and door jambs, and even the regenerator faces, being protected.

Heat Regulation

One of the many outstanding advantages that result from the cross-over flue design is the simplicity of regulation of heat distribution in the vertical flues. In Koppers ovens a necessary feature of heat distribution is the adjustment of a series of about fifteen sliding bricks at the top of the vertical flues in each half of every heating wall. While this method of regulation was the best devised to give reasonable results with the older type of oven, it was imperfect at best, and oven men will be quick to appreciate a design which will largely or wholly eliminate the necessity for making sliding brick settings.

In the Becker oven a number of cross-over flues may be used, so that for every group of five or six vertical flues there will be a centrally located cross-over flue. In consequence, the motive pressures in all vertical flues will be nearly identical without sliding brick regulation.*

Flue Temperature

The performance of the Becker oven in respect to speed of coking, uniformity of heat distribution, and quality of coke produced has been so far in advance of the best former practice that considerable misunderstanding seems to exist as to how the improved results are obtained.

Perhaps the most common error is the belief that the increased rate of coking is due to the use of higher flue temperatures. This is positively not the case. Flue temperatures on the extremely short coking times now obtained are no higher than formerly used, in fact, they are commonly somewhat less than the temperatures necessary to obtain the rated carbonizing capacity in older types of oven. For example: 12-hour coke is being regularly pushed from the 14-inch Becker ovens of the Weirton Steel Co., Weirton, W. Va. The temperature in the flues of these ovens (the temperature of the air port bricks taken just after gas reversal) averages 2500°F., as compared with average temperatures of 2600° to 2650° F. maintained in the Koppers ovens when operating near their full rated capacity. Yet the Weirton ovens, in spite of their lower operating temperature, have a 50% greater carbonizing capacity.

Decreased Width of Oven

It has been demonstrated that there are advantages to be obtained by the use of a narrow oven chamber, especially when coking straight high volatile coal, or coal of inferior coking quality. Many of the Becker ovens being constructed are relatively narrow, having an average width of 14″ or less, with a 1½ to 2″ longitudinal taper. It is obvious that a reduction in oven width will shorten the coking time somewhat more than is proportional to the reduction in width, and it seems to have been thought by some that this was the explanation of the short coking time obtained in the Becker oven. The fact is that the actual rate of coking, that is, the average thickness of coal coked per hour, has increased, owing to the improved uniformity of application of heat to the oven wall.

At the plant of the Chicago By-Product Coke Co. it has been found that the 16″ Koppers ovens require a coking time of 16 hours, while the 14″ Becker ovens,

*For a complete discussion of the principles involved, see "Heat Distribution in Improved Type Koppers Company's Combination Coke and Gas Oven," by Jos. Van Ackeren. Read before the Feb. 1923 meeting of the A. I. M. M. E. New York City.

of the same height and length, if operated at the same temperature, will carbonize the coal in less than 12 hours. Thus the Becker ovens carbonize 25 tons of coal daily, compared to the Koppers ovens' carbonizing capacity of 19 tons. The Becker ovens at the Weirton plant and at the plants under construction are capable of carbonizing 30 tons per oven per day.

Reduced Horizontal Flues

A most important improvement achieved in the Becker oven is the great reduction in cross-sectional area of the horizontal flues. These flues had reached such dimensions in the Koppers oven that they considerably shortened the vertical heating flues, and thus reduced the wall area available for direct flame heating. Yet they could not be placed higher in the wall without overheating the gas space and affecting the by-product yields.

With the Becker oven it is no longer necessary to wait for the top of the coal charge to coke after the bottom of the charge is finished and being overcoked. The extremely uniform heating of the oven wall from top to bottom and from end to end is responsible for the consistent improvement in coke quality which this oven has shown. Tests have shown that a narrow oven does not give this improvement in coke quality unless the heating is extremely uniform over the entire wall.

The elimination of the large horizontal flue, has permitted an increase in oven dimensions, and the Becker ovens are being built much higher than was formerly practicable. This increased height offsets the decreased width in the case of narrow ovens, and the capacity per charge remains approximately the same as before.

Wide Variety of Coals Tested in the Becker Oven

Upon the completion of the first battery of Becker ovens at the plant of the Chicago By-Product Coke Co., there arose an extensive demand for tests of the performance of these ovens on coals of widely varying characteristics. A great number of coking tests have been made on coals from many states, including four coals from foreign countries.

The Becker oven has demonstrated its superiority in coking every type of coal, and the numerous contracts let for its construction have been the result of the demonstrated performance of the Chicago battery on the coals in question. All straight high volatile coals, or mixtures consisting largely of these coals, have been coked in less than twelve hours, with the production of coke superior in physical characteristics to that hitherto obtained.

The coke from the Becker ovens has frequently been compared with that made in the 16″ Koppers ovens at the same plant. The Becker oven coke has always shown a higher combustibility, and an increased percentage is retained on a 2″ screen. The increased uniformity of the coke is usually striking, both on the wharf, and after loading into cars.

THE KOPPERS SMALL OVEN COAL GAS PLANT

Of especial interest to gas men are the small oven coal gas plants which are being constructed by the Koppers Company for the Battle Creek Gas Co., Battle Creek, Mich., and the Consumers Power Co., Zilwaukee, Mich. These ovens are of the Becker type and will be fired with producer gas.

The modern combination by-product coke oven produces high quality gas and

metallurgical coke together with good yields of valuable by-products, and the advantages of this method of carbonization have been thoroughly appreciated by gas men. The by-product coke oven is now a very important source of supply for city gas. In 1920, 53 billion cu. ft. of by-product coke oven gas were distributed through city mains in the United States, as compared to 43 billion cu. ft. of manufactured coal gas sold during the same period.

Until recently, however, by-product coke oven plants having a relatively small gas making capacity (for example—one or two million cu. ft. daily gas production) were not built, and the gas industry had to content itself with other types of carbonizing equipment for installations of this size. To meet the needs of the industry, The Koppers Company now builds plants of this capacity which closely follow the details of larger plants except that the ovens are only half the usual length. This reduction in length permits a substantial saving in certain pieces of mechanical equipment, and in ground space, without introducing any new and untried features. The following advantages are claimed for the small oven coal gas plant:

1. Reasonable construction cost.
2. The obvious advantages of bulk carbonization .
3. Production of coke suitable for metallurgical uses.
4. Greater values in coke and other residuals.
5. Low maintenance cost.
6. Fewer interruptions because of long life of ovens.
7. Great flexibility in production.
8. Economy in ground space.
9. Low labor cost.
10. Satisfied labor because of excellent working conditions.

PLANT OF THE BATTLE CREEK GAS COMPANY

At Battle Creek, Mich., The Koppers Co. has under construction a battery of 11 small gas ovens of the Becker type. These ovens have an average width of 13½ inches with a longitudinal taper of ¾ inch. Their height is 10 ft. 10 in., and the length between doors is 23 ft. 8½ in. The capacity of the oven chamber is 6.8 net tons of coal, and the rated coking time is 12 hours, so that the daily carbonizing capacity of the plant is approximately 150 tons of coal.

Youghiogheny gas coal will be carbonized and the ovens will be steamed during the last hour or two of coking. Since the ovens will be normally heated with producer gas, the surplus gas production can be readily reduced on short notice by firing the ovens with a portion of the coal gas. A still further reduction in gas output is possible by lengthening the coking time. Thus, the small oven plant has great flexibility as regards surplus gas and coke production.

A Koppers Kerpeley gas producer is being installed. The hot producer gas will superheat the steam used in the ovens, and after it has been cooled and cleaned, it will be delivered directly to the oven regenerators.

The gas yield will be increased by passing superheated steam in at the bottom of the ovens during the last hour or two of coking. Only the sensible heat of the coke will be utilized for the water gas reaction, and very little or no additional fuel gas will be burned. Low pressure steam is used in the ovens, and if for any reason whatever it is shut off at the ovens, this steam will be automatically transferred into the producer, releasing high pressure steam for use elsewhere in the plant.

PLANT OF THE CONSUMERS POWER CO.

At Zilwaukee, Mich., a similar plant is being constructed. It will consist of 19 gas ovens of the Becker type, having a capacity of 5.4 net tons per charge and a coking time of 12 hours. The daily carbonizing capacity will be 205 net tons of coal. The ovens will be fired with producer gas from a Koppers Kerpeley producer, and the features described for the Battle Creek plant are incorporated in this installation also.

The oven chambers are 13½ inches in average width with a longitudinal taper of ¾ inch. The oven height is 9 ft. 11 inches, and the length between doors 20 ft. 7½ in. The distance from center to center of ovens is 3 ft. 6¼ in.

BECKER COKE OVEN INSTALLATIONS

In the following paragraphs, seven installations of full size Becker ovens are briefly described. The total number of ovens described is 681.* If former types of ovens had been built throughout, 929 ovens would have been required to give the same carbonizing capacity.

PLANT OF THE WEIRTON STEEL CO.

This plant at Weirton, W. Va., was described in last year's report. Plant operation was begun on July 5th, 1923, less than a year after construction was begun.

This is the first large Becker oven plant to be completed and detailed operating results will soon be available. This plant is already operating regularly on a 12-hour coking time, and the actual daily carbonizing capacity per oven is 28 tons.

See Steam Account 712.

A highly satisfactory coke for metallurgical purposes is being produced from straight high volatile Pittsburgh seam coal.

PLANT OF THE CARNEGIE STEEL COMPANY

The Clairton, Pa., plant of the Carnegie Steel Co. with 768 Koppers ovens is the largest by-product coke oven plant in existence. To this enormous installation there are being added 366 Becker type ovens, which will give an additional daily carbonizing capacity of 8000 net tons of coal. Complete additional by-product and benzol handling equipment is being supplied by The Koppers Company.

The completed plant will have a daily carbonizing capacity of 21,500 tons of coal, and will stand as a striking example of what engineering skill can do in meeting the demands of modern industry.

PLANT OF THE COLUMBIA STEEL COMPANY

At Provo, Utah, The Koppers Company is erecting a battery of 33 Becker type coke ovens with complete by-product, benzol, and coal and coke handling equipment.

A Utah coal not hitherto coked in by-product coke ovens will be used. This coal is in general chemically similar to the Illinois coking coals except for a still higher volatile matter content. The coke produced from this Utah coal in the Chicago Becker type ovens greatly resembles that from certain Illinois coals, many varieties of which have been successfully coked at the Chicago plant.

The ovens will hold 15 tons of coal, and have the following dimensions: Average width, 14 in., longitudinal taper, 1½ in., height, 13 ft., length between doors, 42 ft. 2½ in.

*Excluding the 30 small gas ovens built at Battle Creek, Mich., and at Zilwaukee, Mich.

On a coking time of 12 hours, and with a coal weighing 50 lbs. per cu. ft., these ovens will carbonize 30 net tons of coal per 24 hours.

PLANT OF THE REPUBLIC IRON AND STEEL COMPANY

At Youngstown, Ohio, The Koppers Company is building an addition of one battery of 61 Becker ovens to the present Republic Iron and Steel Company plant of 143 Koppers ovens.

The daily carbonizing capacity of the new battery will be 1500 tons of coal. Oven dimensions are: Average width, 13¾ in., longitudinal taper, 2 in., height, 11 ft. 10⅛ in., length between doors, 40 ft. 8 in.

The contract includes all additional by-product, benzol, and coal and coke handling equipment.

LACKAWANNA PLANT OF THE BETHLEHEM STEEL COMPANY

At Buffalo, N. Y., The Koppers Company is building two batteries of coke ovens for the Bethlehem Steel Company. The ovens number 114, each holding 12 tons of coal. Oven dimensions are as follows: average width 14 in., longitudinal taper 1½ in., height 12 ft. 6 in., length between doors 36 ft. 4½ in. The contract includes by-product and benzol equipment.

PLANT OF THE TRUMBULL CLIFFS FURNACE CO.

At Warren, Ohio, a battery of 47 Becker type ovens is being constructed. This battery of narrow (14″) ovens will carbonize 1325 net tons of coal daily, a remarkable record when compared to the capacity of former types of ovens. Complete by-product, motor fuel, and coal and coke handling equipment is included in this contract.

The longitudinal taper of these ovens is 1½ inches, the height 12 ft. 6 in. and the length between doors 40 ft. 8 in. Straight high volatile coal will be carbonized in these ovens.

PLANT OF THE DIAMOND ALKALI CO.

The Diamond Alkali Company has awarded to The Koppers Company a contract for the construction of 23 Becker type ovens including by-product and benzol recovery plants at Alkali, Ohio. A hard blocky coke suitable for calcining lime will be produced.

The ovens will have a capacity of 15.2 tons per charge, and measure 16 in. in average width with a longitudinal taper of 2 in. The height is 12 ft. 6 in. and the length 40 ft. 8 in.

PLANT OF THE BIRMINGHAM BY-PRODUCT COKE CO.

At Birmingham, Ala., there have been completed 25 Koppers ovens as an addition to the former plant of 50 Koppers ovens.

TWO-TON HORIZONTAL GAS OVEN PLANT AT QUINCY, ILL.

Vernon Baker, St. Louis, Mo.

The Russell Engineering Company now has under construction a new coal carbonization plant for the Quincy Gas, Electric & Heating Company at Quincy, Illinois. The new plant replaces an old one consisting of eight benches of stop end sixes, hand charged and hand discharged. The new plant comprises fifteen horizontal gas ovens; separate chimney for the entire battery; roof covering, floors, galleries; oven equipment and separate outside producer plant for furnishing gas to heat the ovens; the coal and coke handling machinery being furnished by the gas company themselves.

The ovens are arranged in units of three with pier walls between, separating the units. This arrangement permits of heavy buckstaves at each end of each pier wall and strong bracing for the oven doors. The ovens are each 12″ wide, 8′ 5⅜″ high inside and 13′ 3″ long over all. They are designed to carbonize 4000 lbs. coal in twelve hours' time. This rating may be increased by about three hundred pounds. The fifteen ovens being rated at 600,000 cu. ft. of gas per twenty-four hours, allowing for scurfing, etc.

The recuperators for heating the secondary air are arranged in four separate sections for each unit of three ovens with separate control for each section. The heating system consists of vertical combustion flues, four rows of heating flues for each three ovens. There are ten vertical flues to each row, eight up flues, the two in the center being down flues. The air and producer gas meet at a point just below the bottom of the ovens after passing through nozzles of a size carefully designed to pass just the right amount of gas and air to each up heating flue.

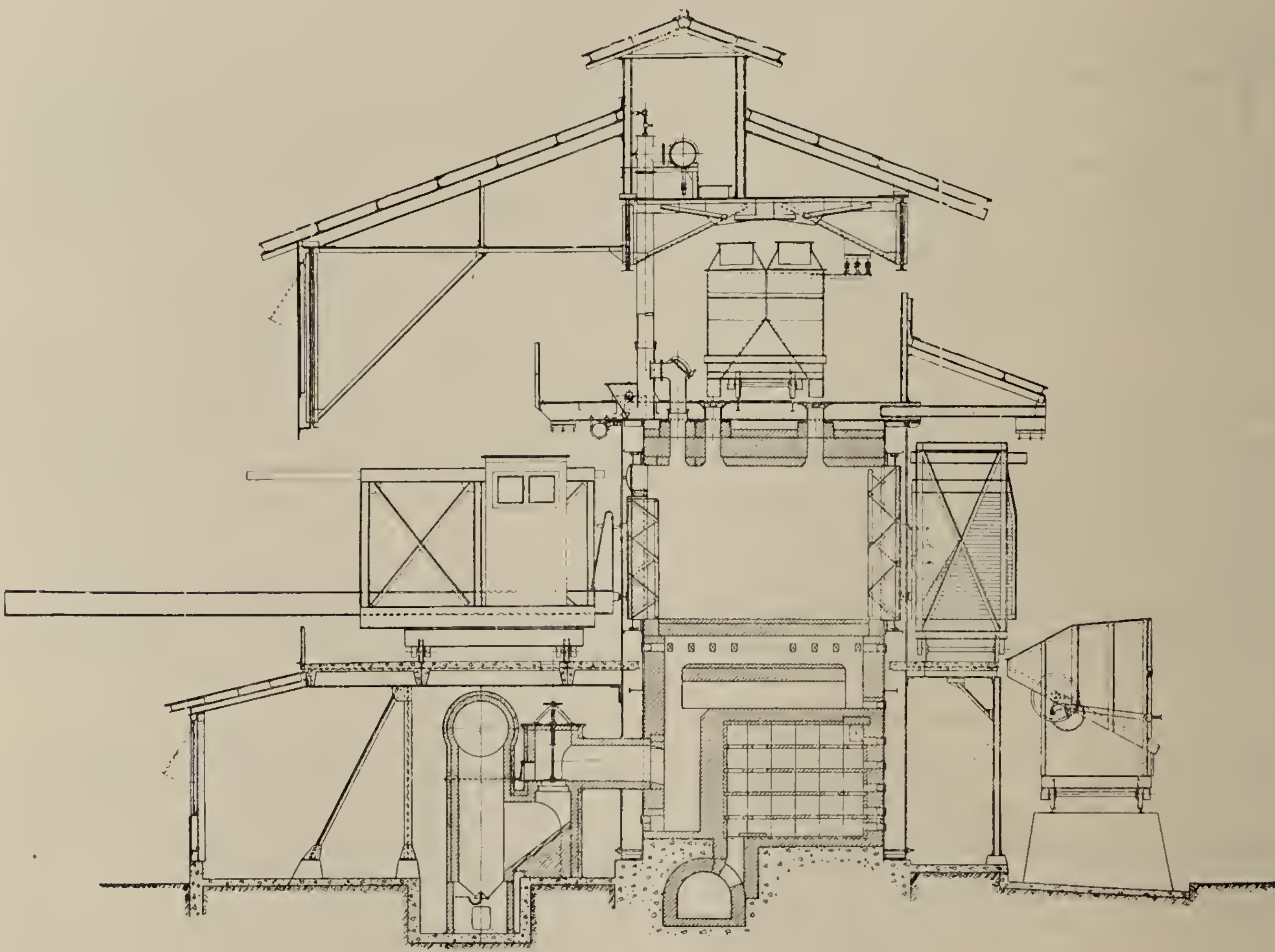
The horizontal collecting flue at the top is located just below the coal line so as not to overheat the gas evolving from the coal in the oven. A damper at the top of each vertical up flue controls the amount of gas and air for that flue. The dampers in the recuperators regulate the chimney draft on the entire unit and incidentally the heating of each half of the unit.

One important feature of the design is the accessibility of all flues for observation and cleaning purposes, the horizontal flues being accessible from both the pusher and coke sides.

A separate outside chimney of reinforced radial fire clay tile will take care of the waste gas from the entire battery. The chimney is 3′ 6″ diameter x 100′ high.

The oven doors are of the self-sealing type, consisting of heavy cast iron frames held to the brick work by means of beams and adjusting screws, which beams are in turn held by the buckstaves. The doors are flexible and are held to the frame by means of steel latches swinging on hinged lugs attached to the frame. The latches are tightened by means of eccentric pins. The doors have inner baffle plates to hold the coal away from the doors and within the heating zone.

The gas offtake pipes are 10″ diameter and discharge directly into the scrubber standpipes through short horizontal connections, there being one scrubber pipe to each oven. Each scrubber pipe is provided with a valve which will shut off the oven completely when charging and drain pipe leading to the separating well in the yard. A small liquor pump returns the liquor to the sprays. As far as known to the writer this is the first installation of horizontal gas ovens to utilize the Congdon Scrubber Standpipe System.



RUSSELL ENGINEERING CO.
ST LOUIS, MO
2 TON GAS OVENS
HEATED WITH PRODUCER GAS

discharging. This pipe connects at the top directly to the gas collecting main (or foul main) and has a liquor spray at the top and at the bottom dips into a seal box. The gas passes upward from the oven through the scrubber pipes to the foul main and the spray liquor passes downward carrying the particles of tar, dust, etc., with it into the seal box. The seal box has an overflow through which the tar and liquor continuously pass to a

The gas collecting main is sloped from each end of the battery towards the center from which point it is carried overhead to the condensing house. It is provided with a drain at the center of the battery which connects to the above mentioned tar and liquor drain.

The ovens are protected from the elements by means of a roof covering which is of novel design in that it is supported

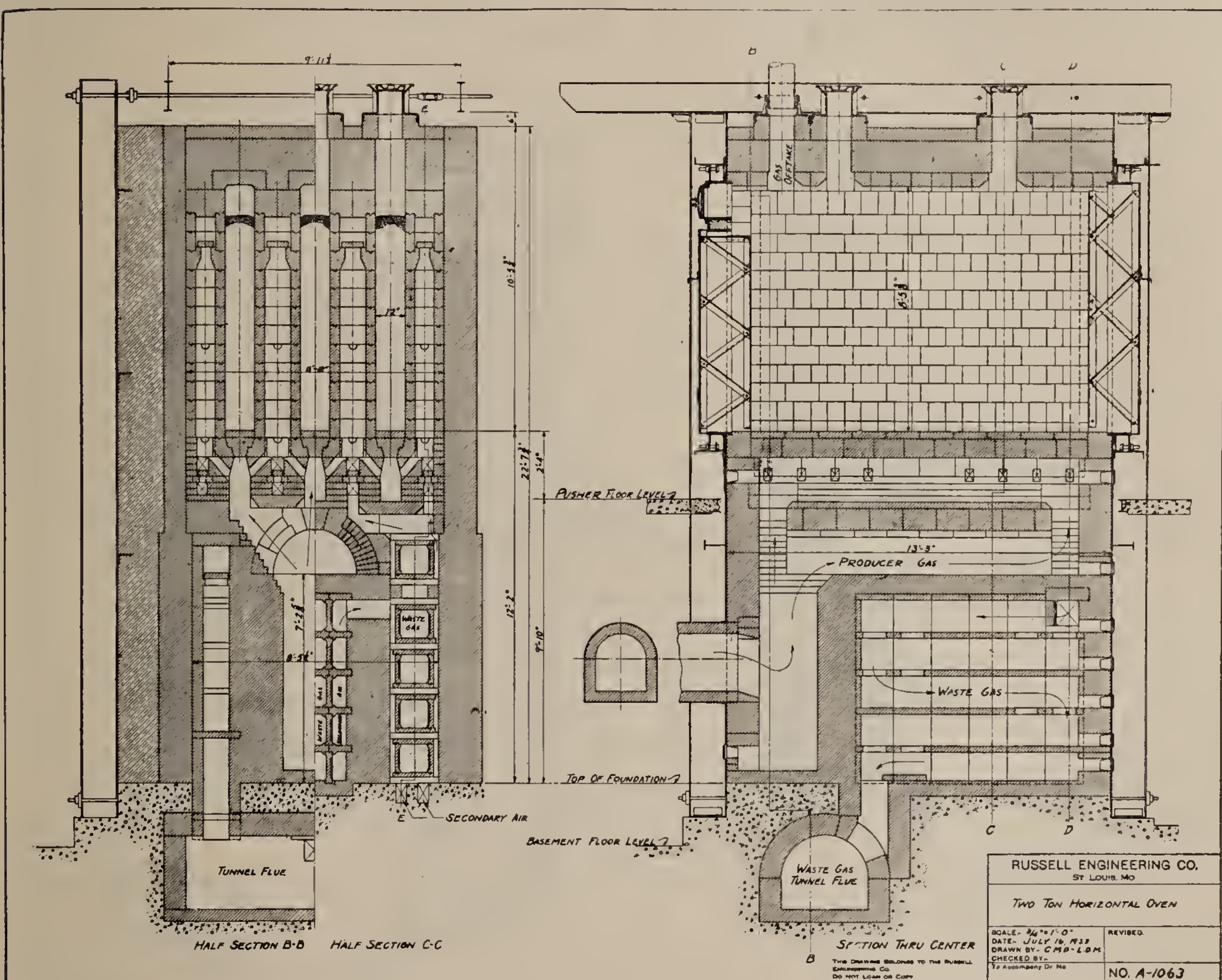
on longitudinal trusses extending for the full length of the battery, which trusses in turn are supported on columns located at each end of the battery, the entire structure being independent of the brick-work and buckstaves. The building is all of steel framing throughout and roofed over with asbestos coated corrugated sheets. The sides and ends are also housed in with the same material, steel window sash giving light and ventilation.

The charging floor over the ovens is supported on the buckstaves and, in addition to carrying the track for the coal charging larry, supports the scrubber pipes.

The floors at pusher level on both pushing and coke side are constructed of steel framing and reinforced concrete and carry the rails for pusher and door extractor. These floors will be extended at one end to form the operating floor for the producers; at the other end to provide for stairs, passage, etc. These floors also form protecting cover for work space below.

The oven equipment consists of pusher—leveler—door extractor; coal charging larry; door extractor and coke guide on coke side and hot coke car, all of heavy construction. This equipment is being built by the Atlas Car & Manufacturing Company.

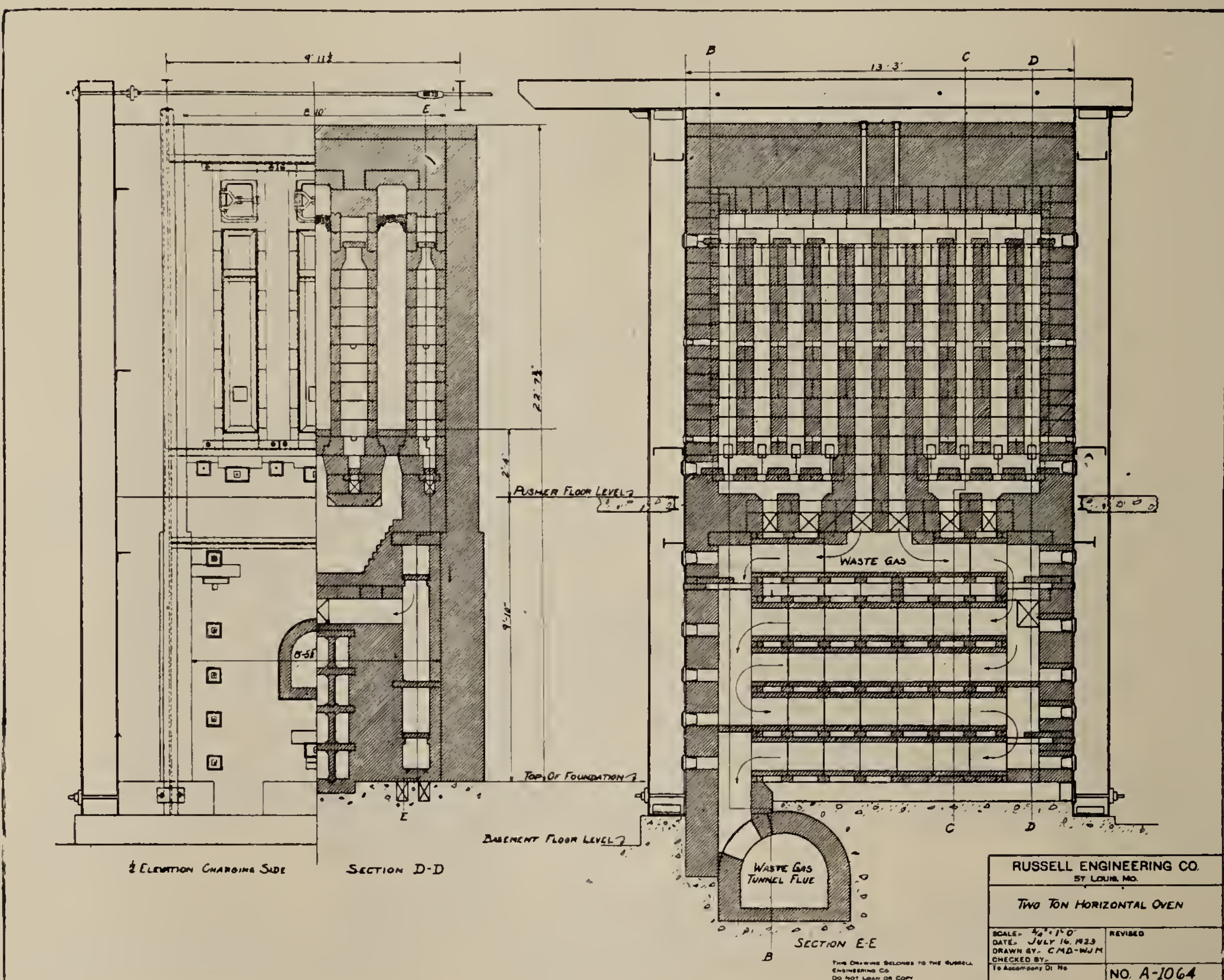
The pusher and coal larry are motor-driven, the coke guide and door machine is hand operated. The coke car is pro-



pelled by means of a cable haul which is motor-driven and operated by distant control, the push buttons being located on the door extractor machine on coke side so that the operator can spot the car in front of any oven, under the quenching tower or at the coke wharf without leaving his station.

exhaust steam. These producers are designed to burn either coal or coke, but it is the intention of the gas company to burn Illinois coal from Franklin County.

The gas, after it leaves the producer, enters a soot leg and from this soot leg passes to a cyclone dust arrester and



The ovens will be heated by means of hot producer gas, this gas being generated in a 10′ diameter producer being built by the Chapman Engineering Company. There will be two producers furnished, one for reserve. Each producer is equipped with automatic coal feed, floating agitator and steam blowers for introducing air and live steam under the fuel bed. A positive air blower with venturi meter may be used as an alternate with

from there to the gas main extending along the front of the ovens. At each unit of three ovens there is an additional soot leg and a cross connection provided with a mushroom valve for regulating the amount of gas to that particular unit. The soot legs, dust collector and the gas mains will be insulated with 2½″ of Sil-o-cel brick and provided with an inner lining of 4½″ of fire brick. The gas lines are also provided with suitable clean out

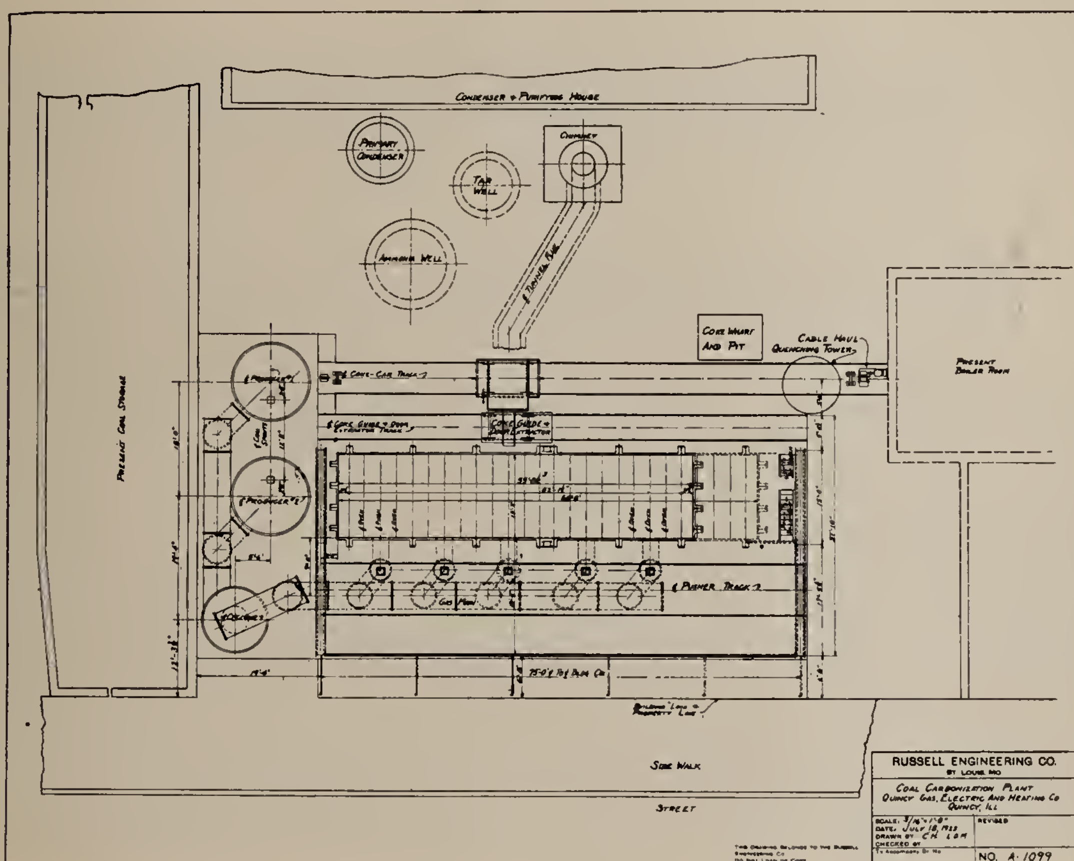
and explosion doors and steam blowers for removing soot and dust from each portion of the line when required.

The coal and coke handling system beyond the ovens is being provided by the gas company. The coal will be brought from the existing coal shed to an overhead bunker located at the ends of the ovens by means of a skip-hoist. This bunker is divided into compartments to hold gas coal for the ovens and steam coal for the producer.

The coke, after it has been quenched in the car, is discharged onto a wharf and then into a coke pit and from there on into a skip-bucket which will carry it over the coal shed to the present coke screening tower.

The cuts printed with this description show the design of the ovens, the roof covering, the floors, producer plant and equipment, as well as the general layout of the plant.

The plant is being built in two sections on account of the necessity of keeping some of the old benches in operation until a portion of the ovens are making gas. After the first three units or nine ovens are in operation, the second section of six ovens will be built. The building structure will, however, be built to accommodate six units of ovens and will be arranged for further future extension.



It is expected that the first section will be ready for making gas this fall.

Reconstruction of Benches at St. Louis, Mo.

The Russell Engineering Company also has underway the rebuilding of twenty benches of 20′ Through Horizontal Eights at Station A of the Laclede Gas

Light Company. This work includes the rebuilding of the main arches, the refacing of the pier walls, refilling of the benches above the top of the furnace arches and the furnishing of new bench mountings and gas collecting main.

The retort sections are "long" silica sections. The ends are formed "short" clay heads built in 18″ front walls.

The Congdon Scrubber Standpipe System is being installed to take the place of the old system of individual stand, bridge and dip pipes for each retort. The scrubber pipes will connect at the top directly with a new gas collecting main, the old hydraulic main being abandoned and in consequence there will be no seal. Retort house governors will be installed to maintain a constant pressure condition in the retorts. The scrubber pipes discharge the spray liquor and tar into seal boxes located at basement floor, the tar and liquor then pass through overflow to drains and to the separating well in the yard.

It is expected that one battery of ten benches will be ready for making gas about September and the second battery about one month later.

REPORT OF THE U. G. I. CONTRACTING COMPANY. PHILADELPHIA, PA.

J. H. Taussig, Philadelphia, Pa.

In May of this year, The U. G. I. Contracting Company completed at the Philadelphia Gas Works a Vertical Retort Plant, with its accessories, including coal and coke handling, waste heat boiler and gas treating plant. This plant has a capacity of 2,250,000 cu. ft. per day.

It consists of 9 benches of 9 retorts with a cross section of (18″ x 30″) at the bottom. It is heated by means of two 10′ 6″ producers, one being a standby.

The water jackets of these producers are equipped with steam drums to collect the steam made in the water jackets.

This steam is at 5 lbs. pressure and is conducted into the main exhaust steam system where it is used as an endothermic for the producers.

Each producer is equipped with a separate drive.

The ashes are taken from the collecting hoppers of the producers and wheeled to a skip hoist, which in turn discharges the ashes into an overhead bin.

The producers plant is equipped with a complete set of collecting and distributing flues, heavily lagged, also with a dust arrester for extracting all of the dust out of the hot gas.

One of the most interesting features is that the coke from three retorts is discharged hot, into a cast iron motor-

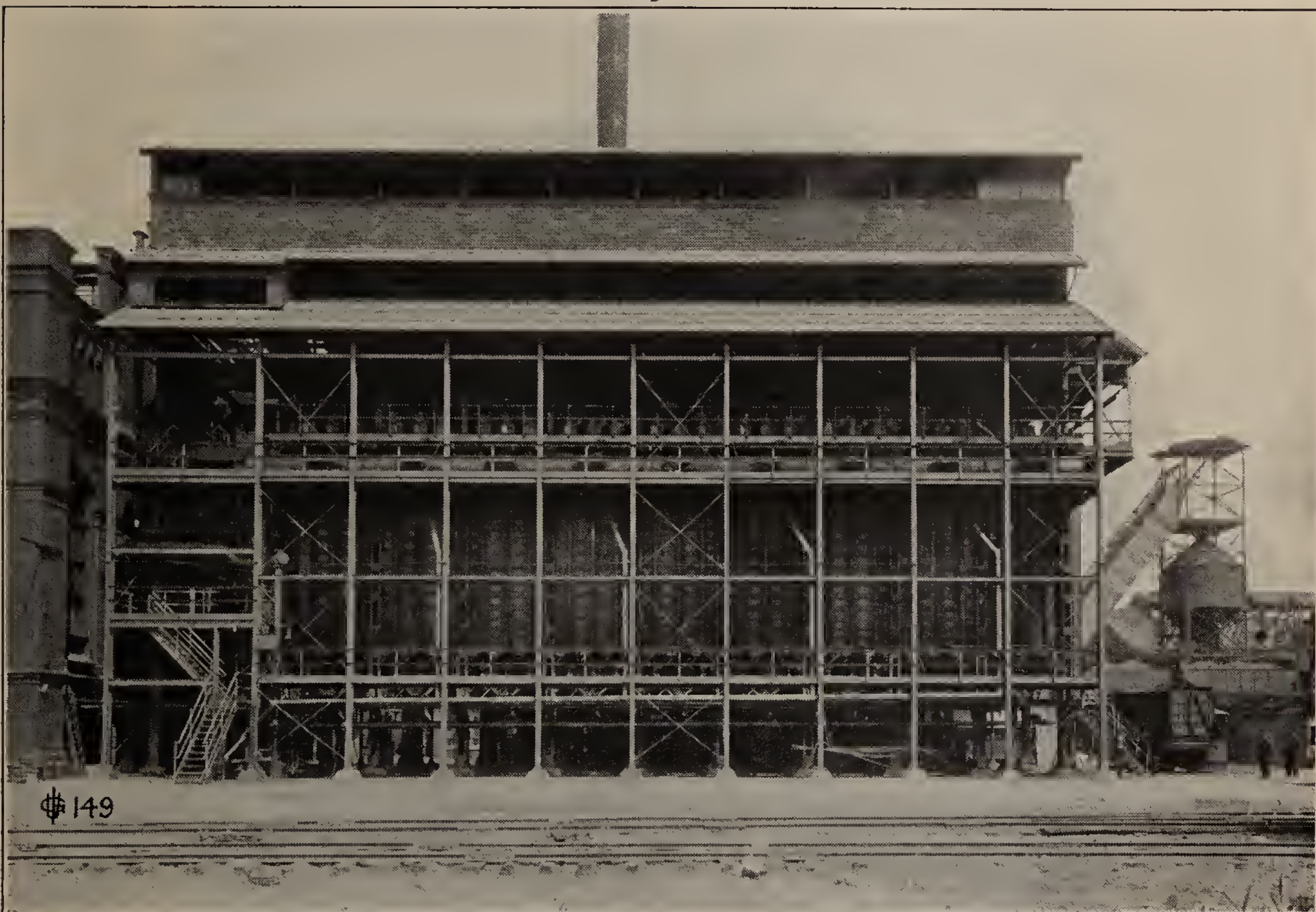
driven car and is delivered, without quenching, to a large skip hoist holding the entire charge. The skip hoist discharges the coke into a heavily lagged over-head bin, which is located above the operating floor of the water gas house. The hot coke is screened on its way to the water gas charging wagons, so that all the coke that is delivered to the water gas sets, is not only hot, but contains no breeze.

The water gas house in which this coke is used contains twelve 11′ sets, with very shallow fuel depth. The use of the hot coke enables the entire fuel bed to be active, and the generator fuel results have improved considerably in consequence.

The fuel as delivered to the water gas sets is just the proper size for water gas work.

All the lump coke made is required for water gas making, which is used, as mentioned above, without quenching.

The breeze screened under the hot coke bin is returned to the producers, and what additional fuel is required, is purchased from a nearby steel plant and consists of small coke of very poor quality, containing over 20% ash and 10% moisture.



To summarize—this plant is able to deliver a clean high grade fuel at a red heat or above to the water gas generators. The fuel used for producer fuel is only the dust screened out of the hot coke and a cheap and normally unsalable fuel from a steel plant.

The plant is being operated with two shifts per day—there being a period both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in the morning and in the evening, where no operators, other than a single producer man, are required.

Manchester, N. H.

There is now being erected at Manchester, N. H., a U. G. I. Vertical Retort Plant, consisting of 5 benches of 9's, having a capacity of 1,250,000 cu. ft. This plant will be equipped with all coke and coal handling apparatus, coke screening plant, by-product recovery plant and purifying plant.

This plant differs from the one built in Philadelphia by being of the attached producer type; each bench having a producer as part of the unit. These producers are of the U. G. I. shaking step grate type.

The retort house will be completely housed, so as to protect the operators from severely cold weather.

The plant will also be equipped with a waste heat boiler.

Producers

During the past year, The U. G. I. Contracting Company have furnished and erected at Providence, R. I., two of their new 10′ 6″ producers, each producer being equipped with a waste heat boiler. The necessary gas washing and cleaning plant, together with all auxiliary equipment was also furnished.

These producers are equipped with electrically driven charging hoppers and water jackets equipped with steam drums.

Gas from these producers will be used for heating the coke ovens at the Providence plant.

Each producer has a capacity of 40 tons of nut coke and between 35 and 40 tons of 50% mixture of nut coke and breeze.

Racine, Wis.

At Racine, Wis., an additional 8′ 6″ U. G. I. high pressure producer has been furnished to act as a standby for the producers already installed.

New U. G. I. Vertical Retorts

During the past year, The U. G. I. Contracting Co. have been developing an improvement on their intermittent vertical retort plant. This improvement was accomplished by simply elongating the cross section of each retort one foot, keeping the width and taper the same. This small change in cross section increases each charge by 50%.

In this manner, not only is the bench capacity increased by a very small additional cost of setting, but it has many other advantages.

It can be readily seen that 50% additional coal can be carbonized in the plant without any additional retort operating labor.

All the main features of the present type of setting are maintained, but among the new improvements are cast steel bottom mouthpieces, larger lower take-off pipes and small improvements on many details of the setting.

GLOVER-WEST VERTICAL RETORTS, CONTINUOUS TYPE

E. G. Blackwell, New York, N. Y.

In our last report, published in these proceedings for 1922, a description was given of the latest developments of Glover-West benches to permit maximum results to be obtained by steaming. Since that date, two contracts to build plants with these features have been entered into—one for Watertown, N. Y., and the other for Malden, Mass.

Watertown, New York

This plant is being built for the Northern New York Utilities, Inc., and consists of sixteen retorts. The retorts are arranged in two benches of eights with two producers for each bench, the retorts being heated in units of two.

Malden, Massachusetts

This plant is being built for the Malden and Melrose Gas Light Company and consists of forty (40) retorts. The retorts are built in four benches of ten retorts arranged in two rows of five.

Victoria, B. C.

In the last report, a description was given of the Glover-West plant at Victoria. Results of the first year's working have been given by Mr. Hewlings of the Victoria Gas Company in a paper read before the Canadian Gas Association in August of this year.

TEST ON BACKRUN DEVICE, STATION "J" DETROIT CITY GAS COMPANY JULY 12, 1923*

Purpose of the Test

THE OBJECT of this test was to determine the economies, if any, to be effected by the installation of the Backrun device on a standard Water Gas machine.

Certain increases in capacity and fuel efficiency are claimed by the vendors of the Backrun device, and we wished to substantiate or disprove these claims.

Location of Test

The test was made at Station "J" because at that Station it was possible to run one machine constantly, entirely independent of fluctuations in sendout.

Furthermore, Station "J" is equipped with fairly adequate blowers, steam at a high initial pressure and suitable devices for measuring or weighing the air, steam and fuel supplied to the machines and the gas produced. The machines themselves are of a modern type, with large connections; the screening facilities allow a uniform quality of fuel to be supplied to the machines, and uniform conditions favorable to a maximum make of gas can be more readily maintained there than at any other Station.

Equipment

Screening

The conveyor belt from the track hopper delivers the coke to a revolving disc grizzly with three-quarter inch spacing. The screened coke is delivered to the water gas bin and receives a final screening as it leaves the weigh-larry on a three-quarter inch round hole plate screen. Both screens were blanked off during the unscreened retort house coke test.

Weighing Generator Fuel

This was weighed on a six-thousand pound capacity weigh-larry travelling on an overhead track and delivering coke directly to the generator.

Air

This was furnished either by an American Blower Company fan having a rated capacity of twenty-thousand cubic feet per minute at 42″ static pressure direct connected to a 200-h.p. Westinghouse turbine or by a General Electric Company centrifugal compressor of the same rated capacity direct connected to a 208-h.p. Curtis type turbine. Generator air was measured by Clark Blast Meters having a total range of from zero to twenty-thousand cubic feet per minute or by a Venturi Meter furnished by the U. G. I. Contracting Company. No attempt was made to measure air to the carburetter.

*The above description of Test forms a part of the 1923 Committee Report on Carbonization and Complete Gasification of Coal.

Steam

This was furnished at 140 lbs. to 150 lbs. gauge pressure and measured by orifice meters furnished by the Gas Machinery Company or the U. G. I. Contracting Company. The gauges read directly in pounds of steam per minute.

Oil

This was Mid-continent oil. It was measured by standard oil meters furnished by the makers of the machines.

Gas

This was measured by Thomas meters.

Ash and Clinker

Was weighed on standard platform scales.

Machines

The tests on screened retort house coke, the tests on unscreened retort house coke both with and without the Backrun device, and the test on screened oven coke with the Backrun device were conducted on a 11′ Gas Machinery Company machine of standard construction.

The test on screened coke oven coke without the Backrun device was conducted on an 11′ cone-top standard U. G. I. Contracting Company machine.

Measurements

The facilities for making these have been described.

Oil Meters

These were tested against a calibrated tank before and after the tests and found accurate within the limits of error.

Steam Meters

These were checked before each test and at intervals throughout the tests. All that could be done to these meters was to insure that the gauges on the up and down steam read alike and that the results were therefore comparative.

Thomas meter

This meter had frequently been checked against wet drum meters and found accurate. The balance was checked before, during and after the tests and remained constant.

Weigh Larry

Was checked with standard weights before the beginning of the test and at intervals between tests and any slight errors found were corrected.

Sampling

Samples of Generator Coke were taken from each alternate coking and transferred to a large covered metal can. One sample was taken for each eight-hour shift. Moisture was determined daily for each shift, and a sample ground for complete analysis.

Coke Recovered from Clinker was weighed, coned and quartered and a sample taken from each cleaning for moisture and combustible determination.

Oil

A sample was drawn each hour from the oil line on the generator charging floor and a portion of the combined sample sent to the laboratory for distillation and other tests.

Gas

Finished gas samples were taken from the purified gas line at the meter. Each analysis was made on an eight-hour holder sample.

B.t.u. Tests

Were made hourly on a one-hour holder sample.

Blue Gas Samples

Were taken hourly. In the case of the up-run they were taken from the top of the generator. In the case of the down-run they were taken from the down-run connection. In the case of the Backrun they were taken from the Backrun connection between the bottom of the generator and the seal.

They were taken on the third run after coking, throughout the up-run, back-run or down-run. Some times samples were taken on both the up and down or Backrun each hour and some times they were taken on alternate hours.

Blast Gas Samples

Were taken on the third blow after coking at the superheater stack. These were taken hourly.

Temperatures

In the case of the test on screened oven coke without Backrun, temperatures at the top and bottom of the superheater were taken with Brown Indicating Pyrometers. In every other test these temperatures were taken with Hoskins Indicating Pyrometers. Temperatures were read just prior to oil admission on each run.

In all tests temperatures of gas in the gas offtake into seal were taken by a Brown Indicating Pyrometer with the bare thermocouple inserted into a point about midway along the gas offtake. Temperatures were read at the end of the up-run and at the end of the back-run.

Breeze from Dust Trap

This was weighed at each cleaning period and a sample sent to the laboratory for moisture and combustible determination.

Sizing Generator Fuel

A sample (1500 to 2500 pounds) was drawn from the weigh-larry every eight hours. It was forked on a 1¼″ standard fork and the oversize weighed. The remainder was screened on a one-half inch square mesh wire screen and both the oversize and undersize weighed. The percentages of each size were then calculated.

General Remarks

The best practice elsewhere seems to indicate that these machines should produce 3,500,000 cubic feet of gas per twenty-four hours, under the following conditions:

Coke

H_2O 5.0%

Ash 8.0%

Fuel to be of uniform size and all over one inch square mesh wire screen made of 3/16 inch wires.

Air

21,000 cubic feet per minute at 42″ static pressure at the machine.

Our coke did not meet these specifications, neither did we have quite the requisite amount of air available.

In all cases sufficient time was allowed prior to each test to establish what was thought to be a satisfactory cycle and to bring the machine to a normal operating condition. We used in each test as much air as we could continuously put through the machine from cleaning period to cleaning period and used only so much blasting time as was necessary to maintain a proper fuel bed condition and proper superheater temperatures. Nevertheless, in the light of our subsequent ex-

perience, we would in several cases still further modify the cycle and would expect to obtain better makes and better oil and fuel results.

Our oil results were not as good with the Backrun as without it.

In order to maintain 600 B.t.u. on our tests with the Backrun, when all the oil had to be admitted in about one minute and forty seconds, we had to enlarge the openings of our oil spray nozzles to a point where we materially reduced the effectiveness of the spray. We noted that we were not securing effective oil atomization and to check up on this we made a subsequent test, primarily to secure maximum oil efficiency.

This test showed us that we could obtain at least as good oil results with the Backrun as without the Backrun, by maintaining a somewhat higher temperature at the bottom of the superheater, and by using a properly designed oil spray.

A few significant figures on this test shown in comparison with similar figures from the test on screened oven coke without the Backrun, are as follows:

	Without Backrun	*With Backrun*
Gas per 24 hrs. (cu. ft.)	3,701,000	3,748,000
Oil per thousand "	3.42	3.42
B.t.u. per "	587	603
B.t.u. per gallon	77.5	82.1

In this case the make of gas was purposely limited so as to insure a figure on oil efficiency which would be comparable with the test on screened oven coke without the Backrun device, when the make, as shown by the table, was approximately the same.

It is probable that if we had been making 540 or 520 B.t.u. gas the problem of oil admission would have been simplified and the benefits accruing from the Backrun would have been greater.

The carburetter checker brick were examined before and after the test with the Backrun device. The brick had a considerable, closely adherent deposit of ash on them. There was, however, no carbon deposit on the brick, and the flues were clear and open. The test was not continued long enough to determine whether or not the vendors of the device were justified in claiming that it would at all times preserve the checker brick free from carbon.

Naturally, we were at first inclined to question very seriously the accuracy of a test which showed such large savings in generator fuel per thousand cubic feet of gas made by the use of the Backrun. We accordingly checked up as carefully as possible the weights of fuel, clinker and ash, and recovered coke, and the measurements of air, steam, gas, etc. Having satisfied ourselves that no serious error existed in these figures, we made a calculation showing some theoretical savings obtained by the use of the Backrun, based on some assumptions, and on data obtained during the test.

It may be pointed out that this test was not run primarily to make possible a complete heat balance and much data which would be necessary for this purpose was not obtained. The most considerable assumption we had to make was in connection with the total air going to the set.

No provision was made during the test for the measurement of carburetter air. We consequently assumed that the carburetter air per thousand cubic feet of finished gas was constant and used the figure of 710 cubic feet per thousand cubic feet of finished gas, given by Mr. O. B. Evans in his paper, "The Heat Balance of a Carburetted Water Gas Set," page 736, Volume 7, Proceedings of the American Gas Institute.

When operating with the Backrun there is a decrease in the volume of carburetter air required, due to the fact that it is not necessary to furnish heat to bring the Backrun gases to the temperature of the superheater. There is, however, a similar volume of carburetter air necessary to furnish the heat which superheats the Backrun steam to the temperature at which it enters the generator. These two factors approximately cancel each other, and we have accordingly used the figure of 710 cubic feet of carburetter air per thousand cubic feet of finished gas in the calculation of the savings obtained in tests both with, and without the Backrun.

The calculation, above referred to, is given in the following pages and accounts for a theoretical saving of 5.09 pounds of generator fuel by the use of the Backrun device as against the 5.16 pounds saving shown by the test.

THEORETICAL CALCULATION OF SOME OF THE HEAT LOSSES FROM A WATER GAS SET WHEN OPERATED WITHOUT BACKRUN EQUIPMENT

BLAST GASES

TABLE "A"

Analysis		*Weight per cubic foot (Pounds)*	*Weight per thousand cubic feet Mixture (Pounds)*	*Mean Specific Heat*	*B.t.u. to heat one thousand cubic feet Mixture 1°F.*
CO_2	18.4	0.11637	21.41	0.29	6.21
CO	0.6	0.07407	0.44	0.27	0.12
O_2	0.3	0.08463	0.25	0.23	0.06
N_2	80.7	0.07429	59.95	0.27	16.19
Total			82.05		22.58

SENSIBLE HEAT CARRIED AWAY BY BLAST GASES:

Generator air per thousand cubic feet	1593 cubic feet
Carburetter air per thousand cubic feet	710 " "
Correction for CO content	8 " "
Blast Gas per thousand cubic feet finished gas	2311 " "
Final temperature blast gases	1429°F
Initial temperature blast gases	80°F
Difference	1349°F

1349 × 22.58 (from Table "A") × 2.311 = sensible heat carried away by blast gases per thousand cubic feet finished gas .... 70393 B.t.u.

MAKE GASES
BLUE GAS

TABLE "B"

Analysis		*Weight per cubic foot (Pounds)*	*Weight per thousand cubic feet Mixture (Pounds)*	*Mean Specific Heat*	*B.t.u. to heat one thousand cubic feet Mixture 1°F.*
CO_2	5.05	0.11637	5.87	0.27	1.58
O_2	1.0	0.08463	0.85	0.23	0.20
CO	38.9	0.07407	28.81	0.27	7.78
H_2	49.0	0.00530	2.60	3.81	9.91
CH_4	2.55	0.04234	1.08	0.63	0.68
N_2	3.50	0.07429	2.60	0.27	0.70
Total			41.81		20.85

PROPORTION OF BLUE GAS IN FINISHED GAS:

From CO content $\frac{25.85}{38.9} = 66.5\%$

Therefore: One thousand cubic feet finished gas contains 665 cubic feet Blue Gas.

MAKE GASES

TABLE "C"

Analysis		Weight per cubic foot (Pounds)	Weight per thousand cubic feet Mixture (Pounds)	Mean Specific Heat	B.t.u. to heat one thousand cubic feet Mixture 1°F.
CO_2	4.7	0.11637	5.47	0.29	1.59
Esti-) C_6H_6	1.6	0.2064	3.30	0.40	1.32
mated) $C_{2.5}H_{6.5}$	9.2	0.1005	0.25	0.50	4.63
O_2	1.1	0.08463	0.93	0.23	0.21
CO	25.85	0.07407	19.15	0.27	5.17
H_2	33.25	0.00530	1.76	3.81	6.71
CH_4	14.50	0.04234	6.14	0.63	3.87
N_2	9.80	0.07429	7.28	0.27	1.96
Total			53.28		25.46

SENSIBLE HEAT LOST BY MAKE GASES:

Entering temperature .... 80°F.
Final temperature .... 1429°F.
Difference .... 1349°F.

Total heat carried away by make gases, per thousand cubic feet finished gas:
1349 × 25.46 (from Table "C") .... 34346 B.t.u.

STEAM DECOMPOSED TO MAKE BLUE GAS:

66.5% × 490 (cubic feet H_2) × .00530 (weight per cubic foot) × $\frac{18}{2}$ = 15.54 pounds per thousand cubic feet finished gas.

Total steam = 39.10 pounds per thousand feet finished gas.
Excess steam = 23.56 pounds per thousand feet finished gas.

HEAT CARRIED AWAY BY STEAM:

23.56 × 1349 × 0.50 (specific heat of steam) = 15891 B.t.u.

SUMMARY OF HEAT LOSSES PER THOUSAND CUBIC FEET FINISHED GAS

Sensible Heat:
Blast Gases .... 70393 B.t.u.
Make Gases .... 34346 B.t.u.
Excess Steam .... 15891 B.t.u.
Total .... 120630 B.t.u

THEORETICAL CALCULATION OF SOME OF THE HEAT LOSSES FROM A WATER GAS SET OPERATED WITH BACKRUN EQUIPMENT

BLAST GASES

TABLE "A"

Analysis		Weight per cubic foot (Pounds)	Weight per thousand cubic feet Mixture (Pounds)	Mean Specific Heat	B.t.u. to heat one thousand cubic feet Mixture 1°F.
CO_2	16.4	0.11637	19.08	0.29	5.53
CO	1.4	0.07407	1.04	0.22	0.28
O_2	0.7	0.08463	0.59	0.23	0.14
N_2	81.5	0.07429	60.55	0.27	16.35
Total			81.26		22.30

SENSIBLE HEAT CARRIED AWAY IN BLAST GASES:

Generator air per thousand cubic feet	1298 cubic feet
Carburetter air per thousand cubic feet	710 " "
Correction for CO content	14 " "
Blast gas per thousand cubic feet of finished gas	2022 " "
Final temperature Blast Gases	1162°F.
Initial temperature Blast Gases	80°F.
Temperature Difference	1082°F.

1082 $\times$ 22.30 (from Table "A") $\times$ 2.022 = sensible heat carried away by blast gases per thousand cubic feet finished gas = 48742 B.t.u.

MAKE GASES
BLUE GAS
TABLE "B"

Analysis		*Weight per cubic foot (Pounds)*	*Weight per thousand cubic feet Mixture (Pounds)*	*Mean Specific Heat*	*B.t.u. to heat one thousand cubic feet Mixture 1°F.*
CO_2	5.0	0.11637	5.82	0.29	1.69
O_2	0.3	0.08463	0.25	0.23	0.06
CO	38.9	0.07407	28.81	0.27	7.78
H_2	51.6	0.00530	2.73	3.81	10.60
CH_4	2.5	0.04234	1.06	0.63	0.66
N_2	1.7	0.07429	1.26	0.27	0.34
Total			39.93		21.13

PROPORTION OF BLUE GAS IN FINISHED GAS:

From CO content — $\frac{28.5}{38.9}$ = 73.3%

Therefore: One thousand cubic feet finished gas contains 733 cubic feet blue gas.

MAKE GASES
TABLE "C"

Analysis		*Weight per cubic foot (Pounds)*	*Weight per thousand cubic feet Mixture (Pounds)*	*Mean Specific Heat*	*B.t.u. to heat one thousand cubic feet Mixture 1°F.*
CO_2	4.1	0.11637	4.77	0.29	1.38
C_6H_6	1.5	0.2064	3.10	0.40	1.24
$C_{2.5}H_{6.5}$	8.6	0.1005	8.64	0.50	4.32
O_2	1.0	0.08463	0.84	0.23	0.19
CO	28.5	0.07407	21.11	0.27	5.70
H_2	31.9	0.00530	1.69	3.81	6.44
CH_4	14.7	0.04234	6.22	0.63	3.92
N_2	9.7	0.07429	7.20	0.27	1.94
Total			53.57		25.13

SENSIBLE HEAT LOST BY MAKE GASES:

Assuming as per previous paragraph—733 cubic feet Blue Gas per thousand cubic feet finished gas and assuming that this is divided proportionately to the steam per thousand for the Uprun and Backrun.

Then: Backrun gas = $\frac{21.66}{38.45}$ of 733 or 413 cubic feet per thousand cubic feet finished gas.

Taking into account per cent CO_2 on up and backrun and increased per cent CH_4 on backrun we may assume blue gas made on backrun to be 450 cubic feet per thousand cubic feet finished gas.

Then: Sensible heat carried away by make gases on Backrun:

Total heat per thousand above 80°F. on gas leaving at 246°F. from Table "B" = 21.13 $\times$ 166 $\times$ 0.45 = 1563 B.t.u. per thousand cubic feet finished gas.

STEAM REQUIRED PER THOUSAND CUBIC FEET FINISHED GAS:

Steam decomposed per thousand cubic feet to make Blue Gas:

$73.3\% \times 516$ (cubic feet H_2) $\times .00530$ (pounds per cubic foot) $\times \frac{18}{2} =$ 18.0 pounds per thousand cubic feet finished gas.

Total steam = 38.45 pounds per thousand cubic feet

Excess steam = 20.45 pounds per thousand cubic feet

Of this $\frac{21.66}{38.45}$ or 56% goes away on the backrun at a temperature of less than entering steam.

Remainder — 44% — 9 pounds.

SENSIBLE HEAT CARRIED AWAY BY MAKE GASES ON UP RUN:

From Table "C" we have 53.57 pounds make gases. If they were all raised to 1162°F. from 80°F. the rise in temperature would be 1082°F.

Total heat carried away by one thousand cubic feet make gases would be 1082×25.13 or 27190 B.t.u .

From this must be subtracted the heat not taken away by down run gas or 450 cubic feet gas requiring, from Table "B", 21.13 B.t.u. to heat one thousand cubic feet or $1082 \times 21.13 \times 0.45 = 10288$ B.t.u.

Sensible heat then carried away by make gases 16902 B.t.u.

SENSIBLE HEAT IN EXCESS STEAM:

Equals 9 pounds $\times 1082 \times 050 =$ 4869 Bt.u. per thousand cubic feet finished gas

SUMMARY OF HEAT LOSSES PER THOUSAND CUBIC FEET FINISHED GAS

Sensible Heat:

Blast Gases	48742 B.t.u.
Make Gases (backrun)	1563 "
Make Gases (up run)	16902 "
Excess Steam	4869 "
Total	72076 B.t.u.

SUMMARY OF SOME OF THE THEORETICAL SAVINGS IN GENERATOR FUEL OBTAINED BY THE USE OF THE BACKRUN EQUIPMENT

The previous tabulations show some of the heat losses in Water Gas sets with, and without, Backrun equipment.

Certain savings as indicated below are obtained by the use of the Backrun device.

It may be well to note again that this test was not run primarily to obtain a heat balance and much data which would be necessary for that purpose is not available. Hence, the heat balance below is incomplete and can be taken as indicative only of some of the savings that the Backrun device effects.

For instance, we did not take into account:

Radiation and convection,
Sensible heat of tar,
Latent heat of vaporization of tar,
Heat in the moisture in the coke,
Heat of combustion of the carbon in the ash,
Sensible heat of the material removed during cleaning,
Standby losses due to the combustion of carbon in the generator during clinkering period, and various other factors.

Consequently, the saving accounted for is only a part of the saving which actually took place.

In particular, radiation losses should be lower with the Backrun, due to the increased make per day.

Standby losses should be much lower, due to the fact that the generator doors were open for clinkering for a much shorter time.

For these and other savings we have no data available and they are consequently omitted in this calculation.

Following is a heat balance drawn from data as per previous discussion, showing partially the savings in fuel which can be effected by the use of the Backrun.

B.T.U. BALANCE

	Without Backrun	*With Backrun*
Sensible heat carried away by blast gases	70393	48742
Sensible heat in make gases:		
Up)		16902
	34346	
Down)		1563
Sensible heat carried away by excess steam	15891	4869
Total	120630	72076
Difference: 48554 B.t.u.		

Now this represents a certain saving at the stack, but it does not represent the saving in fuel at the generator.

In his paper, "The Heat Balance of a Carburetted Water Gas Set," Proceedings of the Amercan Gas Institute, Volume VII, Mr. O. B. Evans has calculated the saving in generator fuel effected by a drop in temperature of 100°F. in the exit gases.

He has, page 753, Appendix C, calculated the efficiency of combustion of the generator fuel in his test. This amounts to 60%.

He has then, page 754, calculated the B.t.u. saving at the stack to be effected by a drop in temperature of the exit gases amounting to 100°F. A certain B.t.u saving is effected. This, however, does not represent the saving in generator fuel, because only 60% of the generator fuel furnishes useful heat. Consequently, in figuring the saving in terms of the fuel charged to the generator, he divided the B.t.u. saving by the efficiency.

It may be well to state here, in case anyone should desire to check Mr. Evans' figures against the calculations made here, that the saving effected by the Backrun, as per the foregoing discussion, involves not only a reduction in temperature of the exit gases, but also a reduction in volume of the blast gases. Hence, the saving in terms of generator fuel per 100°F. reduction in temperature of the exit gases is increased.

We have made an attempt to calculate the efficiency of combustion in the generator, as follows:

WITHOUT BACKRUN

Dry generator fuel — 27.21 pounds per thousand = 123000 B.t.u. per pound =		334683 B.t.u.
Sensible heat in Blast Gases		70793 B.t.u.
Heat of combustion of Unburnt CO,		
Heat in the mosture in the coke,		
Heat in the water of combustion of the hydrogen in the coke,		
Heat in the moisture in the Blast above the inlet temperature,		
Sensible heat of the material removed during cleaning,		
Heat of combustion of the carbon in the ash.	Total	24070 B.t.u.
Total B.t.u. Lost		94862 B.t.u.

The miscellaneous items listed above could not be directly calculated, due to the lack of data. Consequently, they were assumed to bear the same relation to the total loss as was the case in Mr. Evans' computation and were calculated on that basis.

This gives us a fairly high figure for generator efficiency which is probably nearer 65% than 72%. However, applying ths figure of 72% to the savings as shown by the table above, we have a saving at the generator of:

$$\frac{48554}{72} \text{ or } 67436 \text{ B.t.u}$$

This in generator fuel at 12,300 B.t.u. per pound represents a saving of 5.48 pounds per thousand cubic feet of finished gas.

Translating this into terms of dry combustible, this is equivalent to a saving of 4.71 pounds. This does not, as we said before, take into account the entire saving due to the use of the Backrun. In Mr. Evans' computation referred to above, certain other savings were effected by a reduction in temperature of the exit gases, i. e.:

Sensible heat in tar

Sensible heat in the water of combustion in the hydrogen in the coke.

These amounted, in his discussion, to 7½% of the total saving.

If this were applied to the saving in generator fuel, as calculated above, this figure would be increased to 5.09 pounds.

To this can be added a figure for radiation, for lowered standby loss, due to the fact that the generator doors were open for clinkering 32% less time with the Backrun than without, and for other savings which will bring the fuel theoretically saved by the use of the Backrun very close to the figure of 5.16 pounds per thousand, the figure shown by our test.

In general we were limited in gas making capacity:

1. By the differential through the generator, due to the character of the fuel.
2. By the danger of blowing small coke over into the carburetter, in the case of unscreened fuel.
3. By the condition of the test which stipulated that a minimum amount of blast gas was to be burned at the stack.

The amount of steam used appears to be higher than in some practice we have seen elsewhere, but aside from the question of the accuracy of the steam meters, we cannot doubt the figures submitted. Investigation of characteristic analysis of gas shows the following figures for steam:

	Without Backrun	*With Backrun*
Metered Steam	39.10 pounds per thousand cubic feet	38.45 pounds per thousand cubic feet
Theoretical Steam	15.54 pounds per thousand cubic feet	18.00 pounds per thousand cubic feet

In spite of this large excess steam, we found that where we reduced the steam we also reduced the amount of gas made.

Analysis of blue gas, moreover, did not show excessive CO_2.

The test was as accurate as it was practically possible to make it. For purposes of extremely accurate determination of results some additional precautions might have been taken to determine the quality of fuel and the amounts of air and steam used. If any errors exist they are to be found equally in the test with, and without, the Backrun. Hence, for comparative purposes, the test may be taken as reliable.

The following is a short summary of the more important results obtained with and without the Backrun.

SUMMARY OF RESULTS OBTAINED WITH AND WITHOUT BACKRUN DEVICE USING UNSCREENED RETORT HOUSE COKE, SCREENED RETORT HOUSE COKE AND SCREENED OVEN COKE AS GENERATOR FUEL.

	Test Using Unscreened Retort House Coke as Generator Fuel		*Test Using Screened Retort House Coke as Generator Fuel*		*Test Using Screened Oven Coke as Generator Fuel*	
	Without Backrun	*With Backrun*	*Without Backrun*	*With Backrun*	*Without Backrun*	*With Backrun*
Gas						
Make per 24 hrs. cu. ft.	1,882,000	2,276,000	3,016,000	3,500,000	3,701,000	4,319,000
Make per running hour cubic feet	99,121	110,162	158,829	166,726	189,866	203,247
Make per running hour per square foot of grate area—cubic feet	1,558	1,732	2,485	2,621	2,985	3,195
Per cent increase in capacity with Backrun		20.93		16.05		16.67
Coke						
Dry coke per thousand cubic feet	43.67	33.21	29.81	25.26	27.21	21.81
Dry combustible per thousand cubic feet	36.10	28.44	25.36	22.18	23.89	18.73
Per cent decrease in generator fuel with Backrun		25.35		12.54		21.60
Oil						
B.t.u. per gallon per cubic foot	79.4	73.3	79.0	77.1	77.5	72.1
Per cent decrease in oil efficiency with Backrun		7.68		2.40		7.0
Total clinkering time hours	4.82	3.36	4.82	2.98	3.95	2.68

DETROIT CITY GAS COMPANY
DETAILED OPERATING AND TEST DATA STATION "J"

	Test With Unscreened Retort House Coke as Generator Fuel		*Test With Screened Retort House Coke as Generator Fuel*		*Test With Screened Oven Coke as Generator Fuel*	
	Without Backrun	*With Backrun*	*Without Backrun*	*With Backrun*	*Without Backrun*	*With Backrun*
Data Collected (1923)	4-18-20 incl.	5-24-26 incl.	5-2-4 incl.	6-1-4 incl.	4-29-30 & 5-1 incl.	6-7-8 incl.
Operating Machine No.	No. 1 Gas Machinery Co.	No. 1 Gas Machinery Co.	No. 1 Gas Machinery Co.	No. 1 Gas Machinery Co.	No. 3 U. G. I. Co.	No. 1 Gas Machinery Co.
Operating Conditions						
Runs						
Split Runs	Min. Sec.	Min. Sec.	Min. Sec.	Min. Sec.	Min. Sec.	Min. Sec.
Up	15	1 45	15	1 50	15	2
Down	2	2 5	2	2	2	2
Up	1 45	10	1 45	10	1 45	10
Order of Runs	S-D-S-D-U	All Splits	S-D-S-D-S	All Splits	S-D-S-D-U	All Splits
Length of Blow	3 min.	2 min.	3 min.	2 min.	2 min.	1 m. 50 s.
Length of Run	4 min.	4 min.	4 min.	4 min.	4 min.	4 m. 10 s.
Length of Purge	10 sec.	10 sec.	9.6 sec.	10 sec.	10 sec.	10 sec.
Air to Generator						
Cubic feet per min. carburetter valve closed	8306	8872	13839	13917	14651	17433
Steam						
Down or Backrun pounds per min.	170	194	234.9	240	245	251.5
Up run—pounds per minute	160	120	194.9	180	204	190
Cleaning Periods						
Number per 24 hrs.	2	2	2	2	2	2
Average single cleaning time (hours)	2.41	1.68	2.41	1.49	1.98	1.34
Operating Time						
Clinkering time (hours)	4.82	3.36	4.82	2.98	3.95	2.68
Down for repairs (hours)	0.23	1.48	0.11	0.03	0.55	0.07
Running time (hours)	18.95	19.16	19.07	20.99	19.50	21.25
Total day (hours)	24.00	24.00	24.00	24.00	24.00	24.00
Running Time						
Coking time (hours)	1.92	2.67	1.94	2.35	2.28	2.10
Blowing time "	7.78	6.43	7.47	6.75	6.67	6.48
Gas making time (hours)	9.25	10.06	9.66	11.89	10.55	12.67
Total running time (hours)	18.95	19.16	19.07	20.99	19.50	21.25
Generator Fuel Characteristics						
Kind	Unscreened Ret. House Coke	Unscreened Ret. House Coke	Screened Ret. House Coke	Screened Ret. House Coke	Screened Oven Coke	Screened Oven Coke
Per cent free water	16.90	16.06	11.4	13.9	1.85	3.96
Per cent volatile	4.82	7.74	2.28	3.60	0.94	0.29
Per cent free carbon	82.49	77.89	82.81	84.23	86.60	85.59
Per cent ash	12.69	14.37	14.91	12.17	12.26	14.12

Sizing Generator Fuel						
Per cent on 1¼″ Fork	27.41	54.31	85.18	74.19	94.56	88.06
Per cent through 1¼″ Fork and on ½″ square mesh wire screen	44.35	35.82	13.45	22.64	4.34	10.79
Per cent through ½″ square mesh wire screen	28.24	9.87	1.37	3.17	1.25	1.15
Oil						
Characteristics						
Be′ Original Oil	34.9	35.5	33.7	33.6	35.1	33.7
Be′ Distillate	36.0	36.3	34.9	34.8	35.3	35.3
Cracking Temp. °F.	778.0	782.0	717.0	793.0	740.0	775.0
Soluble in sulphuric acid per cent	8.3	8.3	16.3	10.0	9.5	11.0
Viscosity Sayboldt	46.0	43.7	62.0	50.3	47.7	49.8
Flash °F.	160	163	178	172	180	174
Fire °F.	194	175	190	190	185	192
Per cent over @ 450°F.	3.0	3.3	8.3	0.75	2.5	1.4
Per cent over @ 750°F.	89.0	93.0	97.8	89.3	99.0	80.0
Heavy oil residue	2.7	1.2	2.2	2.0	1.0	2.2
Temperature						
Top of superheater °F.	1405	1256†	1397	1184	1429	1162
Bottom of Superheater °F.	1422	1460	1422	1432	1432	1430
Backrun Gas °F.		242		250		246
Temperature of Blast gases leaving top of superheater (estimated to be the same as the top of the superheater)	1405	1256	1397	1184	1429	1162
Results						
Gas						
Average daily make (cubic feet)	1,882,000	2,276,000*	3,016,000	3,500,000	3,071,000	4,318,000
Per cent increased capacity with Backrun		20.93		16.05		16.67
Gas made per running hour per square foot of grate area (cubic feet)	1558	1732	2485	2621	2985	3195
B.t.u. of Gas	609	594	604.6	598	587	588
Generator Fuel						
Fuel as charged per thousand cubic feet. (Fuel as per larry weights. No deductions for moisture, ash, recovery from dust trap, or cleaning fires.)	52.66	40.28	34.89	29.93	29.81	23.31

Dry generator fuel per thousand cubic feet. (Corrected for moisture and coke recovered from cleaning fires.)	43.67	33.21	29.81	25.26	27.21	21.81
Dry combustible used for gas making per M cubic feet. (Corrected for moisture, ash and coke recovered from cleaning fires.)	38.10	28.44	25.36	22.18	23.89	18.73
Air to Generator						
Per thousand cubic feet gas made	1947	1593	1846	1448	1593	1298
Steam						
Generator steam pounds per thousand cubic feet	48.90	44.82	44.22	42.77	39.10	38.45
Enricher						
Oil per M	3.62	3.71	3.58	3.58	3.42	3.69
B.t.u. per gallon (B.t.u. observed less 322—assumed B.t.u. of Blue gas—divided by oil per M)	79.4	73.3	79.0	77.1	77.5	72.1
Analysis of Blue Gas						
CO_2	4.7	5.5	5.3	4.8	5.05	5.0
O_2	0.5	0.4	0.8	0.3	1.00	0.3
CO	37.1	36.0	37.3	35.7	38.9	38.9
H_2	52.4	51.9	51.4	52.3	49.0	51.6
CH_4	2.6	3.4	2.5	3.7	2.55	2.5
N_2	2.7	2.8	2.7	3.2	3.50	1.7
Calculated B.t.u.	317	320	313	323	307	320
Analysis of Finished Gas						
CO_2	5.0	4.6	4.9	4.4	4.7	4.1
Illuminants	10.6	9.6	10.7	10.5	10.8	10.1
C_2	0.8	0.8	0.7	0.9	1.1	1.0
CO	25.8	26.7	28.0	26.0	25.85	28.5
H_2	31.2	32.6	33.1	34.2	33.25	31.9
CH_4	19.7	18.2	15.4	16.7	14.50	14.7
N_2	6.9	7.5	7.2	7.3	9.80	9.7
Calculated B.t.u.	608	589	601	602	588	574
Observed B.t.u.	609	594	604.6	598	587	588
Analysis of Blast Gas						
CO_2	16.2	15.6	17.3	16.5	18.4	16.4
CO	1.7	0.4	0.8	0.5	0.6	1.4
O_2	0.7	2.2	0.5	1.4	0.3	0.7
N_2	81.4	81.8	81.4	81.6	80.7	81.5

†This temperature was not the average temperature during the blast, but the maximum temperature. Other figures in the same line represent average temperature.

Test was conducted by L. E. Worthing, Experimental Engineer, with the assistance and cooperation of the Manufacturing Department, A. I. Snyder, Engineer; A. H. Anderson, Sup't of Manufacture; Messrs. L. G. Kreuz, G. T. Bentley and J. Roek, of the operating organization at Station "J", and the Laboratory force at Station "A"; R. M. Pearson, Chief Chemist.

Note.—*Actual make was 2,110 M Cubic Feet. We were shut down 4 hours and 35 minutes for full holders on May 26. The above is based on actual make per hour for the remainder of the day.

A Study of Some Physical Laws Governing the Carbonization of Coal.

Horace Porter (Philadelphia, Pa.): I think we are to be congratulated on the fact that a paper of the value of Mr. Warner's has come from the research department of a company which uses high temperature carbonization and particularly the kind of high temperature carbonization which most destructively breaks down the valuable oils of the primary products. In other words, the horizontal retort.

The author tries very forcefully to bring out the fact that high temperature carbonization breaks down in a very destructive way the primary products of coal carbonization, namely, the valuable oils and rich hydrocarbon gases. I hope that some day we will come to a method of coal carbonization industrially which avoids that.

The proposal to draw the products inwardly through the core of cold material, in other words the raw coal in the center of the charge, means that the raw cold coal in the center will act as a condenser, cooling the hot gases and recovering the heat. If this can be put into practical use without serious difficulties, it looks like a very good thing.

I disagree with his apparent conclusion that the heat saved by this process is the heat required to break down the hydrocarbons and primary products. I think it is rather the sensible heat which in most processes of high temperature carbonization is carried off in the gases and the latent heat of the water and other products which are condensed later.

When a heat balance is worked out it shows a very considerable item in that sensible latent heat of the vapors carried off in the gas leaving the retort, amounting in some cases to 40 per cent of the total heat passing into the retort or out of it.

Mr. Warner proposes that the sensible latent heat of these vapors would be recovered to a large extent. However, several researches on this subject indicate practically 90 per cent of all the oxygen in the coal is carried by the low temperature volatile products. When these are passed through a heated zone, undoubtedly these oxygenated materials react so as to produce some heat rather than to absorb it.

The low temperature oils and tars contain a large percentage of oxygenated bodies of the phenol character, and a large percentage of water is present. When they pass through the high temperature zones, they produce heat rather than absorb heat. Consequently, I believe more stress should have been laid on the recovery of the sensible heat rather than of the heat of the breaking down of the primary volatiles.

If in practice, the clogging of the outlets and pumping the gas off from the interior of the discharge can be overcome, this theory would seem to be a step in the right direction.

Prof. S. W. Parr (Urbana, Ill.): Mr. Warner states in his paper, "If the removal of volatile matter from coking coal were the only consideration, the high heats commonly used in carbonization are unnecessary." As a confirmed disciple of the low temperature carbonization idea, I still think we are inclined to sometimes overstate the case. Since my work has been largely with coals of the Illinois type, I believe that the range

of temperatures which he uses is the limit for the condensible hydrocarbons, and that beyond that it takes a higher heat and a longer time to get the other gas out of the coal, which will make a permanent gas but yield no condensible hydrocarbon.

For instance, he says, in his fourth thesis, that the less the heat through which the gases from the non-condensible hydrocarbons must pass in leaving the retort, the richer will be the gases and the greater will be the B.t.u. feet per unit of the coal. We are apt to confuse the properties of these heavy condensible gases with those which may be driven off at a later stage, and coals of the Eastern type will give off all of the gas that they are going to give off much more easily than this residual gas from certain other coals.

In this fourth thesis, he said, "The richer will be the gases and the greater will be the B.t.u. feet from the source of the unit of coal." For instance in these heavy hydrocarbon gases, the first three feet per pound will average 750 B.t.u. Three feet of that type of gas would yield 2250 feet units. Now if the average gas will yield five feet at 450 B.t.u. per foot, you still have 2250 B.t.u. feet.

So the advantage is not marked, but it suggests the value of these heavier hydrocarbons for some other use than sending them out in the gas mains, as, for example, in the production of mixtures, or the utilization of such gas for enriching leaner gas.

He says in the second proposition: "The condensible hydrocarbons of coal are more valuable as raw products the nearer to their primary state they exist." I would stop with that proposition, as I am not sure what he means when he adds, "Because no way has been found to convert any but a meager portion of them into permanent gas." In the first place, coals differ so widely—some will give a distillate at lower temperatures and it would be of quite different material, more of the resinous type of compound.

We do not know as yet what these condensible compounds are good for. If he means that no way has been found for converting them into permanent gases in the ordinary coke oven, that might be true. We take our chances on what happens to them. But if we want to see what we can do with those heavy hydrocarbons or condensible oils,—what kind of a gas we can make or what they are good for—it seems to me that is for the future, as we hardly know much about it.

The paper is primarily of interest to me because of recent years so much work has been done in England, along the continent and in this country on the study of the action of solvents upon coal, to separate the non-coking constituents from the coking constituents, and this is what he actually does in his experiments. While the ordinary solvent is phenol—or as in our own work we find benzol under pressure the best solvent—he has used the distillation products of coal itself to wash out the coke constituent and leave behind the non-coking constituent.

Whether practical or not that opens up the possibilities of studying the theories of carbonization by having these two things separated and understanding the behavior of one towards the other when they are combined. That phase of the work seems exceedingly valuable.

DISCUSSION

Report of the Operators' Section
Carbonization Yields from Run of Mine
Slack and + ¾″ Coals
Mechanism of High Temperature Coal
Carbonization

J. A. Perry (Philadelphia, Pa.): In going over the Operators' Report by Mr. Klein and the test conducted by Prof. Demorest, I had a few thoughts principally along the line of what kind of plants we are going to put into our works from now on and why, and what kind of a test we want to make to get our facts for putting those plants in.

The testing of coal seems to be a very big problem. A test in one retort gives only part of the story. A test in the whole plant takes so much coal and so long a time that it presents a serious problem. A plant of any considerable size should have one complete bench isolated so that it can treat the gas and the particular coal to be tested complete to the purifiers and get all the facts.

It seems to be fairly easy to get the amount of coke made per ton. In a vertical retort, we can dry out to practically a dry basis the breeze that is charged, weigh it carefully, charge the individual retort, weigh carefully the coal charged into that, and catch the coke while it is hot and weigh it. Thus a very accurate idea of the percentage of coke made is secured.

I do not believe that you can tell much about tar and ammonia except by actual test on a complete bench.

If you over-quench the coke you are going to make a lot more breeze than if you just quench it sufficiently to keep about two to five per cent in it. That brings up the point of what kind of a new plant you should install. Whether coke oven vertical retort, or push-through horizontal. I believe you have to come to the outside producer plant. The right kind of producer will use all the breeze you make leaving nothing but lump coke for sale or use, thus eliminating the breeze question. Of course, if lump coke is available for the producers, you can use it to better advantage.

As to screened coal versus three-quarter inch plus, I have examined seven or eight mines in Kentucky and Tennessee, and you can use slack or any kind of coal from the Rhoda mine with its sandstone roof and clean floor, etc. With other mines having a poor roof and bad floor conditions, etc., you have to screen the dirt and stuff out of the coal before it comes to your plant. It also affects your coke results.

Labor, which also affects the producing question, is not mentioned in the report. With producers you save a lot of labor and make your operating conditions very much more uniform and secure.

The Manchester Company, with a new plant to be in use in early December, have bought and stored a Pennsylvania coal from the Fairmount region, averaging 37% V. M., and a West Virginia coal with about 32% V. M. The ash will average about the same, and there is not much difference in price. The results on these coals should be interesting. Possibly the lower volatile coal will carbonize more quickly, make more

coke; and it may pay us to use it even at the same price.

G. H. Waring (Grand Rapids, Mich.): I believe that these reports will eventually give us statistical data of real value for comparative purposes. The present report covers the situation splendidly in showing that records are not being kept uniformly and that results are not what they should be.

We have found, in operating a group of companies, that furnishing comparative statistical data monthly to each plant has been a wonderful incentive to improved efficiencies of each plant. Through the Association's efforts I hope we will eventually get away from the idea of keeping such data privately. In most cases it is public property filed with the commissions, and why should not the gas companies also have access to it?

The report recommends correcting for temperature and barometer. However, correction for temperature only should be used in arriving at the unaccounted-for gas. In high altitudes, if you use the thirty-sixty correction and deduct the gas sold you will have a negative unaccounted-for, which is rather confusing to utility commissions. So if you correct it for barometer in order to compare with other plants, you should also keep, particularly in the high altitudes, correction merely for temperature.

E. H. Bauer (Providence, R. I.): Referring to the graphic representation of the questions answered by the gas companies; How are we going to deliver to the customer a consistent, uniform quality of material if only 32 per cent of the companies analyze the gas that they send out? How can you please people unless you know what you give them?

You will notice that 3 per cent of the plants do not meter their gas. That is a small number but I think that the committee should write those individual plants with a view to correcting such conditions.

S. B. Sherman (Racine, Wis.): This report is of little value to the industry, as a whole, unless the individual in going over it compares these results in the various plants with his own and tries to find out where he is poorer or better than the other fellow. If he is better and then does not pass on his results to the operators' section next year so that they may be available for the benefit of the members as a whole, it seems to me that the committee's work is entirely lost.

There are some rather interesting comparisons in the operators' reports. The number of B.t.u. feet in the various plants varies considerably.

The number of companies reporting their results is discouragingly small. Only 17 plants operating stop end retorts, 5 operating thrus, etc. Only a small percentage of the various plants are reporting results.

The report indicates to me that more care should be given to coal and coke analyses. One plant in all of its reports had 8% ash in coal and 4% in their coke. I do not believe it is possible. Another one reports 3% ash in coal and 16% ash in the coke. Another one half as much ash in the coal as in the coke. The percentage of moisture in coke varies from a quarter of one per cent to eight per cent, and yet from the rest of the analysis the coke with 8 per cent moisture does not seem to be from the high moisture western coal. It seems to be a standard eastern coal. This moisture may be gathered on the way or in storage; it did not state. The amount of

breeze made means a good many dollars a year to many plants.

Gathering these statistics is a hard job, and I really believe that the members as a whole should give the new chairman, Mr. Willien, considerably more support than was given the past chairman.

In Prof. Demorest's paper, he shows under his coal and coke analysis one case where the ash in the coke is 2.6 times that in the coal of the run of mine; in the ¾ coal 1.7 times, and in the slack or small coal 2.3 times. These figures do not look proper. The ash in the coke compared to that in Pittsburgh coal in the run of mine is 1.6; in the ¾ is 1.4; and in the slack or fine 2.1; while the percentage of coke made was almost identical in each case.

Prof. Demorest mentioned in one of the committee meetings that he was losing in quenching his coke about 2% of the weight due to the flying off of small particles. I would like to ask Prof. Demorest if I am correct in that?

W. H. Earle (Rochester, N. Y.): Prof. Demorest, in his remarks, lays some stress on the idea of operating a carbonizing unit by using the quantity of breeze made as in end point. It seems to me that the quantity of breeze made is affected by many other things than the retort temperatures. It is difficult to determine the quantity of breeze in the coke emerging directly from the retort, and unless determined at exactly that point many other factors enter into the production of breeze that have no bearing on the carbonization. I personally would like to have some further exposition of that idea.

Prof. Demorest's results on Pittsburgh coal are of particular interest to us at Rochester, but I am not prepared to accept his conclusions. In the first place, the plus ¾ coal was carbonized in forty minutes less time than the minus ¾. If that is in any degree a measure of the plant characteristics of the two sizes of coal, it certainly has a very decided bearing on plant capacities, and consequently on investments and operating costs.

Again, the temperatures at which the plus ¾ coal was carbonized are considerably lower than those of the mine run. Conceivably that might have a very decided bearing on his subsequent results.

I assume that the item of B.t.u.'s per pound was obtained by multiplying his gas yield per pound by his B.t.u. per cubic foot, and I am not able to check his B.t.u. per pound on the minus ¾. My figure is 2693, which, of course, would leave a value 100 B.t.u. higher than that in favor of the other two sizes.

Then there is not much difference in the actual yields of coke, but on his shatter tests there is a very decided difference in coke from the plus ¾ coal, and that is also noticeable, as between the per cent under ½″ comparing the plus ¾ with the minus ¾, which in coke returns would be a very considerable item.

The tars are obviously considerably in favor of the plus ¾ coal, although possibly the quantity of tar has some bearing on the lower coking temperatures mentioned above.

There is not sufficient information as to ammonia per ton of coal in the slack size to make a comparison on that basis. But on the above few points, without going into comparative cost values, it seems to me that there is considerable in

favor of either the run of mine or the plus ¾ in comparison with the slack size.

A. C. Klein (Boston, Mass.): Answering Mr. Earle as to the value of determining the amount of breeze, the committee has stressed a great many points that it feels should be considered in controlling a coal gas plant. I stressed that one point because the greater number of companies failed to keep any records of their breeze. The amount of breeze made is a valuable index for any operating man, and if he finds that suddenly the amount jumps up, he can very quickly know that he should look for trouble.

It would be very well worth while for gas companies that contemplate purchasing considerable quantities of coal to actually inspect conditions of the mining of the coal. As Mr. Perry says, in some mines, where the mining conditions are right, it does not matter particularly whether you get ¾ or slack coal or run of mine coal. If a coal mine has a 7-ft. or an 8-ft. seam, and they will leave four or five inches on the floor and from ten to twelve inches on the roof, providing there is no difference in quality of coal throughout the seam, they will get a uniform quality of coal, whether it be lump or fines.

If, however, the coal company is trying to extract the maximum tonnage from their veins, they will scrape up a little dirt from the floor and pull it down from the roof, and this for the most part will go into this slack. In such cases it would pay the companies to pay a premium for the ¾ screened coal.

J. H. Taussig (Philadelphia, Pa.): For stocking purposes there is no question that a lump coal will stock easier, and be less liable to catch fire, than a mixture of lump and fine.

It would be interesting to have this test continued to see the effect of higher ash products. We have always thought, and rough works tests have shown, that ¾ screen coals have given higher results. In the days gone by we used to buy ¾ screen coal at a differential of fifteen cents. Now they want more differential. I think if we could decide among ourselves just what the differential value is to us it would be worth while.

We know very well a mixture of rough and slack will contain and hold more moisture than clean lump coal. In the winter time, you might have a lot of ice in the slack, or in bringing the coal down from the mines the rains might soak into the slack. We have to distill a great deal more moisture out of the mixed coal than the lump coal. That should be given credit.

Prof. Wilson should continue his fine work on the rate of carbonization. His curves showing results under set conditions of temperature were mighty interesting. The whole Association could be benefited by seeing what the effect of temperature would be, say from three points, 1000° F. inside the oven, 1,500° and 2,000°, because there is certainly a wide difference in the rate of carbonization.

I want to second Mr. Sherman's remarks on tabulating results. We must have standards for results, and any manager who tells the carbonization committee that he has not kept the results is simply admitting he is not efficient or getting the best results.

J. P. Haftenkamp (Rochester, N. Y.): Prof. Demorest said that the difference between run of mine and ¾ was not very much. What is "very much"? We ran

a test at Rochester, the details of which Mr. Beebe can describe, but the results vary with those of Prof. Demorest.

A. M. Beebe (Rochester, N. Y.): Our test was on run of mine and screened ¾ coal from the same mine as that sent to Prof. Demorest, also the same type equipment was used in both tests. We are at a loss to explain why our conclusions are so opposite.

We ran the run of mine along with our regular ¾ coal over a period of two months the percentage of ¾ coal depending on how it happened to come in. In the curves plotted over the two months' period, with one exception, taken from day to day or week to week, whenever there was an increase in the run of mine there was a drop in the B.t.u. feet per pound, and vice versa where there was a decrease in the run of mine the B.t.u. feet per pound increased.

Taking the curves and striking them off, we found that for each per cent increase in run of mine coal we lost 4.9 B.t.u. feet per pound, and vice versa it was figured 5.1 B.t.u. gain for each per cent decrease in run of mine. In other words, there was some 40c a ton justification for ¾ coal. This is on a large scale operation, about 500 tons a day. Whether that is the answer or not I do not know, but certainly our results at this time were strongly in favor of the ¾ coal.

C. J. Ramsburg (Pittsburgh, Pa.): This is the first time, I think, that any experimental work has been done in a university on this size apparatus and the interpretation given to this Association to use as data for operation. Before we use these conclusions in everyday work, this whole test has got to bear the most careful scrutiny. I cannot conceive of a vertical retort making only 5 pounds of ammonia. I know they do a great deal more than that at Rochester, and when from a first-class ¾ screened Pittsburgh coal they get only 5 pounds of ammonia, immediately it indicates something different from what is ordinarily secured in a vertical retort plant.

Another thing that to me throws a doubt on the experiment is that where we would get a yield of 27 pounds of sulphate from ¾ Pittsburgh coal, we would expect to get only about 24 pounds from Rhoda coal, and that is borne out in all the coke ovens around the country. The nitrogen content of Rhoda coal is such that it does not give the yields of ammonia. On the other hand, Rhoda coal will give at least 10% more B.t.u.'s per pound than the best Pittsburgh coal. However, in the tabulated result of this experiment, you find very little difference between the B.t.u.'s from Rhoda and Pittsburgh coal per pound; and the light oil yields have only about 2½ gallons from either one.

I think we should thank Prof. Demorest for the work he has done and study the report carefully before adopting too much of it as final. Our experience in the coke oven work is that you can pay considerably more for the ¾ screened coal and still get your money back.

Run of mine coal carries a great deal more oxygen in it. That cuts down the B.t.u.'s per pound that you get; it increases your carbonic acid; it affects a great many factors in your coal carbonization. It cuts down the quality of coke. I am not prepared to quote from our tests, but we have made up our mind that the lowest ash coal you can procure is pretty nearly the cheapest coal that you can buy.

Warren S. Blauvelt (Terre Haute, Ind.): In considering the difference between screenings and coal over ¾", one item has not been mentioned, which with some coals is very important, namely the relative quality of mother coal or mineral charcoal carried by the particular coal under consideration. This mother coal is non-caking and its presence in any considerable quantities affects adversely the structure of the resulting coke, and causes an excessive yield of breeze. As the percentage of mother coal in the screenings is commonly much higher than in the screened coal, screenings from certain coals are not satisfactory for coke making, even though the lump coal may be used successfully.

There are some mines, however, which produce coal containing very little mother coal, and the screenings are so low in ash and sulphur, that, for coke making, they are practically equal to the higher priced lump coal from the same mines.

A corollary to Professor Wilson's demonstration that the narrower the oven, the more rapid will be the rate of carbonization at any given heating flue temperature, is that at a relatively low temperature, more coal per hour can be carbonized in a narrow oven than in a wide oven. As Mr. Warner showed, there are distinct advantages in avoiding excessive temperatures in carbonization. Hence we conclude that better commercial results in by-products may be obtained from the operation of narrow ovens at moderate temperatures than from wider ovens operated at higher temperatures. The narrower oven also gives a more uniform quality of coke from the wall to the middle of the oven than is obtained from a wider oven.

Prof. D. W. Wilson (Cambridge, Mass.): I have had in mind for a long time investigating the effect of temperature, and have had a little information on it on rate of carbonization. However, under practical operating conditions, it is difficult to get just what you want in the way of temperature variation for test purposes, but I hope something can be done on that later.

The temperature variations that Mr. Taussig spoke of are a little wider than I had ever hoped to obtain.

E. H. Bauer (Worcester, Mass.): In Prof. Demorest's absence I want to say that his end-point on his tests was taken where the gas coming off had a certain B.t.u. and did not include the gas that could have been driven off of the charge. Therefore, some of the products were lost not only in gas but in the yields of ammonia, etc., and the results are not comparable with everyday practice.

J. H. Taussig (Philadelphia, Pa.): Prof. Demorest could only make one charge in 24 hours to clean up his apparatus. Of course, that is not a standard way of operating coal gas plants, and therefore it cannot be compared with the way in which one charge is dropped out and another one charged. His results are only indicative, and the only way you can make a test on a single retort or oven to absolutely compare with working results in a plant is to take a great deal of coal and a great deal of time and charge continuously for a week or two so that the lag between one kind of coal and another will not show. But as anyone will know who has made any small tests or laboratory tests, you can get very indicative results that way.

Report of the Complete Gasification of Coal Section

The Proposed Process for Complete Gasification of Coal by the Use of Oxygen

G. E. Whitwell (Tacoma, Wash.): Mr. Willien's paper probably appeals more to us on the Pacific Coast than to anybody else. There is no general panacea. The complete gasification section in trying to find out and ascertain certainly whether or not a given process was practicable and the cheapest after all, has looked at it the only way it can be looked at.

In Mr. Willien's paper they use a cost for electric current of one cent. They heat houses in Tacoma, Washington, for half a cent a kilowatt and they cook for a cent a kilowatt. We can undoubtedly get power for the generation of oxygen for one-tenth of a cent per kilowatt, and inasmuch as power is pretty nearly the largest cost in the generation of oxygen, we have believed for some time that if there is any part of the country where that will start it will be in the Pacific Northwest. We would prefer a cost of a cent for oxygen and not a half cent for heating and a cent for cooking, but we can get it, we believe, for a tenth of a cent as off-peak power.

With regard to a piece of pipe and a couple of valves that constitute the equipment necessary for the Backrun Process. I believe there also, that you cannot apply a general panacea to all conditions. Very little equipment is required. On the other hand, out of 62 installations in operation or under construction, each one has presented difficulties requiring a different method to overcome them.

With regard to the operation of the backrun as reported from Detroit, in that particular test, no attention apparently was paid to the results which accrued due to the reduction of the temperature of the outgoing gas in so far as condensation is concerned. Each one of you, however, will realize immediately that if you can have your gas leave the washer at a temperature not more than 15 degrees lower than it did before, your condensing problem will be very materially lessened, because of the difference in the degree of saturation of that gas with moisture. In our own experience we have actually run across conditions where condensing capacity has been practically doubled because of this feature.

In Washington we have been operating a complete gasification plant as the sole source of gas in one plant for about two and one-quarter years. The fuel used is the Washington coal referred to by Mr. Hood as being useless for gas-making purposes. It runs 16 to 18 per cent ash, 67 per cent water, and is under a quarter inch. We have succeeded, in complete gasification, in substituting that for coke pound for pound with a decrease in capacity of 20 per cent. That is not included in the committee's report at our own request, as we still consider it experimental, and so limited because of the extreme nature of the fuel conditions out there, that we preferred to await its trial with eastern coals.

A. W. Warner (Chester, Pa.): I think we should express our thanks to Mr. McIntire for his clear presentation of the status of Low Temperature Carbonization.

In comparing the products of low temperature carbonization to those of high temperature, we can approach the economics of the products somewhat as follows: If low temperature carbonization yields say 100 lbs. of tar per ton of coal beyond that yielded by high temperature processes, we can make some guess as to what has happened to this 100 lbs. of tar in processes involving higher heats. This tar has become some 38 lbs. of gas, 22 lbs. of heavier tar, and 40 lbs. of carbon. Let us assume roughly that gas as it leaves the retort is worth 1c per lb., tar in each case ¾c per lb. and coke ⅜c per lb.

100 lbs. tar		$0.75
38 lbs. gas	$0.38	
22 lbs. tar	0.165	
40 lbs. coke	0.14	
	$0.685	

Applying these values, we must come to the conclusion that, aside from any altruistic conservation of our natural resources, any economies resulting from low temperature carbonization of coal must, for the present at least, come from sources other than the ultimate products. The increased oil yield may bring no more monetary return than the same products degraded.

Marked economies, however, may come from:

1. Size and quality of domestic fuel
2. Bench fuel economy
3. Lower capital charges
4. Absence of troubles, direct or indirect, resulting from high temperature products of degradation
5. Labor and maintenance.

In addition to Mr. McIntire's classification of experimenters, some are also trying to produce in one stage a coke possessing all the excellent physical characteristics of by-product coke without the relatively high volatile matter but of suitable size for domestic use without crushing. They believe that the full yield of low temperature oils and the relatively high volatile matter can be removed at comparatively low temperatures.

In talking with the average low temperature carbonization enthusiast, it strikes me that he has a habit of kidding himself in that he is wont to deduct from the market price of the finished low temperature products his own estimate of the cost of refining, to arrive at an optimistic value for his oils.

In 1922 I followed very closely some 30,000 gal. of low temperature tars from the producing plant to the finished products. These products consisted of tar acids, light and dark shingle stains, creosote oils and pitch. The average selling price f.o.b. works was 21c per gal., yet when all the costs of refining and marketing were taken into account, the net return to the refiner was the same as that from specialties made from high temperature tars at the same price per gal. of crude. At any rate the enthusiast has no right to figure refining profits to the credit of low temperature processes.

If, aside from the products, we can not see greater profits in low temperature than in high temperature processes, we must be satisfied with high temperature conceptions of carbonization. I venture to predict that economies other than products will soon put low temperature processes in the field and at capacities well under 1000 tons of coal per day's throughput.

ADJOURNMENT.

SECOND SESSION

Wednesday Afternoon, October 17, 1923.

The Chairman: I feel that I ought to preface the first report with a few rather personal remarks.

Shortly after the year began last fall, one of the prominent members of the Board said that if a committee could be appointed to work with the gas companies and the manufacturers of meters, to the end that the number of sizes and capacities, etc., should be vastly reduced to a relatively few standard sizes, this man would use his influence in the Association and elsewhere to try to get the standards generally adopted. That is also in line with the movement that was initiated by Secretary Hoover in the direction of simplification of apparatus generally.

So we feel that the work that has been initiated this year, and which incidentally moved a very marked step forward under Mr. Forstall, is entirely different from anything that has ever been accomplished before. Therefore, I want you to realize particularly that a matter of very great importance, both to the industry and to the manufacturers of meters, is presented in the report of the Committee on Standardization of Capacities of Consumers' Meters.

THE REPORT OF THE COMMITTEE ON STANDARDIZATION OF CAPACITY OF CONSUMERS' METERS

Walton Forstall, *Chairman*, Philadelphia, Pa.

The Committee on Standardization of Capacity of Consumers' Meters submits the following report as of this date.

The Committee

H. S. Bean, Bureau of Standards, Washington, D. C.

W. C. Beckjord, American Light & Traction Co., New York City, N. Y.

Walton Forstall, Philadelphia Gas Works, Philadelphia, Pa.

W. Griffin Gribbel, John J. Griffin & Co., Philadelphia, Pa.

A. H. Hall, Central Union Gas Company, New York City, N. Y.

Donald McDonald, American Meter Company, New York City, N. Y.

T. V. Purcell, Peoples Gas Light & Coke Co., Chicago, Ill.

George Wehrle, Denver Gas & Electric Co., Denver, Colorado.

The above membership represents the largest users and makers of tin case consumers' meters. The committee has limited its initial effort to tin case meters because it desired to do one job at a time.

Its Origin

The committee was organized in response to a growing demand among meter users that a determined attempt be made towards standardization, primarily of capacities within the same size case, but including, where necessary, dimensions of case or internal parts.

Its Work and Plan

The first consumers' meters in this country were of English make. Presumably they served as a pattern for the first meter of American make. Since that day, until the British standard of 1922, construction on both sides of the Atlantic has represented the opinion of the individual manufacturer almost entirely, or possibly his opinion based on what he thought was the need or desire of the user.

Except in the matter of the meter screw only, the user has been slow to recognize the value to him of capacity and case size standardization. Recently, however, as the two and three part rate for gas emerged from theory into practice, the unnecessary and serious handicap imposed upon the industry by the existing meter situation won sufficient recognition to start a movement which it is hoped will not cease until the end is reached.

The existing meter situation needs to be considered from two points; first, meters in use but no longer made, and second, meters as now made. It is of course impossible to know accurately what sizes are still in use the manufacture of which have been discontinued, but the follow-

ing table does not err in over-stating the number of sizes, nor the variation in the capacity for each size, as the smaller sizes, though shown with one capacity, undoubtedly vary in capacity by as great a percentage as the larger sizes.

Tin Case Meters Not Now Manufactured But Still in Use.

Size	Capacity	Size	Capacity
3	65	60	475—
5	90	100	600—875
10	140	150	1015—1350
20	200	200	1380—1845
30	280	300	1635—2270
45	315		

It is not surprising that finally an attempt was made to improve in two ways the situation represented by the above table. First, to increase the capacity obtained from a given size of case, and second, to utilize this advantage by decreasing the number of sizes made. In 1907 the A. G. I. was asked to consider a new schedule of capacities, then and now known as the "A" schedule. Unfortunately, the industry as a whole was not then sufficiently interested to study the question and the "A" schedule met with limited adoption and insufficient attention as to its merits or defects. Gradually, however, both manufacturer and user realized that increased capacities were not only obtainable, but desirable, and this resulted in the "B" schedule. As neither the "A" nor the "B" schedule provided for capacities above 3500 cu. ft. per hour, the "C" schedule, involving a decided departure in construction, was designed by the Peoples Gas Light & Coke Company of Chicago to meet the need created by the industrial use of gas in large volumes.

Therefore, the committee today finds that practically all the tin case meters now manufactured are shown in the table below.

Tin Case Meters Now Manufactured.

Size	Capacity	Size	Capacity
5 B	150	100 B	1800
5 A	175	25 C	2500
10 B	260	150 A	3400
10 A	375	200 B	3500
20 B	450	40 C	4000
30 B	600	60 C	6000
30 A	875	170 C	17000
11 C	1100		
60 B	1200		
60 A	1500		

Except at Chicago, where the "B" schedule is used for sizes below 11C, users are buying according to either the "A" or "B" schedule. Users of the "A" schedule believe the meters are in general giving increased capacity as compared with the "B" schedule at less first cost per unit of capacity, without undue increase (having reference to economy of investment) in error of registration or shortening of life. Users of the "B" schedule have, in view of the excellent performance of these meters, been disinclined to experiment with increased capacities at the possible risk of poor performance. The limited use of the "C" schedule has followed naturally because of the comparatively few situations needing meters of capacities greater than the 3400 or 3500 cubic feet available from "A" or "B" meters, from the growing tendency to recognize more fully the advantages of using more than one meter for the very large user, (in other words the use of meters in parallel) and from the conservatism of the average meter user to whom the "C" design seems an unproved mechanism.

From the above description of current meter practice today, it is clear that the work before the committee consists in bringing together the users of the three meter types and determining what agreement may be possible between the now existing divergent viewpoints. To this end as soon as the committee was in possession of the facts as to the use of A, B, and C meters it first placed these facts

before the A. G. A. membership through a notice in the April Monthly; and second, asked the largest users of the three types whether they were willing to take part in an investigation of each type; and appoint a representative on a sub-committee for such investigation. A prompt and hearty response was forthcoming and the following sub-committee organized:

At this writing the progress is indicated by the recommendations below. It is quite uncertain what further proposals the committee, through its sub-committee, will be able to submit to the Technical Section at the October convention. The committee believes, however, that the subject is of such great importance and lends itself so well to informal discussion that, in addition to

Name	Position	Interest Represented
E. J. Bartel,	Supt. Meter Dept., Brooklyn Union Gas Co.	Brooklyn Union Gas Co.
H. S. Bean,	Chief, Gas Measuring Instrument Section, Bureau of Standards, Washington, D. C.,	U. S. Bureau of Standards
Thos. E. Boyd,	Supt. Gas Meter Division, Denver Gas & Electric Light Co.,	H. L. Doherty & Co.
W. A. Castor,	Supt. of Meters, Philadelphia Gas Works,	United Gas Improvement Co.
G. A. Lane, Ch'rman,	Supt. of Meters, Peoples Gas Light & Coke Co., Chicago,	Peoples Gas Light & Coke Co.
J. H. Muller,	Supt. Meter Shop, Consolidated Gas Co. of New York,	Consolidated Gas Co. of New York
D. A. Powell,	Supt. of Distribution, Milwaukee Gas Light Co.,	American Light & Traction Company
J. D. McIlhenny, Jr.,	Supt. Helme & McIlhenny, Philadelphia, Pa.,	Meter Manufacturer
Norton McKean,	Supt. Nathaniel Tufts Meter Works, Boston, Mass.	Meter Manufacturer
Walton Forstall,	Chairman, Committee on Standardization of Capacities of Consumers' Meters,	Ex officio

Its Progress

To date only a start has been made on this job of meter standardization which is as difficult as it is important. There is no desire to minimize the obstacles in the way, nor to expect that any standard can be put in use over night. Once, however, substantial agreement is reached upon governing dimensions and capacities, everything should naturally follow in the fullness of time. The adoption of any standard may well be coupled with a true schedule for its gradual coming into use and for the equally gradual freeing of the manufacturers from the burden of supplying non-standard repair parts. It is very important to realize that no standard, however carefully considered before adoption, will care for itself, and there should be a standing committee of users and manufacturers charged with this responsibility.

the formal presentation and discussion of this report as provided for on the program, there should be an informal meeting at Atlantic City of all interested meter men to consider the work of the sub-committee as of that date.

Its Recommendations

The Committee recommends that as a first step in the standardization of tin-case consumers' meters, the following schedule of case sizes and capacities be adopted:

Single Diaphragm Type		Double Diaphragm Type	
Case Size	Hourly Capacity	Case Size	Hourly Capacity
5	150—175		
10	250—375		
20	450		
30	600—875	11—C	1100
60	1200—1500	25—C	2500
100	1800	40—C	4000
150	3400		
200	3500	60—C	6000
250	5000		
500	7500—9000	170—C	17000

That the work be continued by next year's Managing Committee.

Walton Forstall (Philadelphia, Pa.): I would like to just describe briefly what we have done since we wrote that report in July.

The sub-committee has held two very interesting meetings, one in July and one meeting on Monday. As a result of the meeting in July the sub-committee appointed two of its members, Mr. J. D. McIlhenny, Jr., and Mr. Norton McKean, to get together and see what suggestions they might have to make as to combining in one case all the good points that there might seem to exist in the A and the B types. As a result of that it already appears that if we put in the eight and five-eighths diaphragm and use that for a five case, we are going to find a five case meter which will be at least worthy of trial. This, of course, is still tentative.

Those two men are going to devote their attention to the five case and to the ten case first, because most of our money is tied up in small meters.

If the sub-committee can agree on what you might call the best bet just now in a five case and a ten case, those two designs will be recommended to the main committee. The main committee has been chosen with great care with reference to the people who buy and who make the greatest number of tin case meters in this country, so that they will be able to see that enough thousands of what we might call those experimental meters are put into use. Once in use it will be a question of time as to what the next step shall be. This thing will not be settled in a day or a year. We have been going a hundred years or more in the gas business and we have got only a few more thousand years to go, and we might just as well start and get our meter question in better shape than it has been up to date.

We are going to give anybody who wants it, a chance to talk about this thing around the table, where there is no stenographer to bother, in Parlor E of Haddon Hall at two o'clock tomorrow afternoon.

(Upon motion, duly seconded and carried, the report and the recommendations were accepted.)

REPORT OF THE COMMITTEE ON DISTRIBUTION DESIGN

Robert G. Griswold, *Chairman*, New York, N. Y.

Last year's discussion of distribution design was devoted almost exclusively to reducing cost of distribution systems. The scheme discussed at that time was criticized in regard to two features.

First, that the design outlined in last year's paper would be entirely inadequate because the demand on which the design was based was inadequate. In other words, it was assumed that the demand was estimated from the demand on the plant, whereas the effect of diversity factor would be to increase the demands on sub-divisions of distribution systems to such an extent that the design outlined would be unable to give service.

The other criticism was that steel mains were so much more susceptible to corrosion that their use would be prohibitive. Your Committee has, therefore, given particular attention to these two points.

In regard to demand, many people have expressed the opinion that, as the distribution system is sub-divided, the effect of diversity factor would be gradually limited so that the demands on small sections of the distribution system would be very much greater per unit of length than on the system as a whole. One way of testing this is from a table in last year's paper giving a list of a number of different gas companies. In this table, Chicago has the greatest number of customers, and has a maximum station demand per customer of 13 cu. ft. per hour. St. Louis has about a quarter as many customers and the maximum demand per customer is 18 cu. ft. Denver has about one-twelfth as many customers and its demand is 16 cu. ft. per hour per customer. Lincoln, Nebraska, and Spokane, Wash., each represent about one-sixtieth of Chicago's system and have 11 and 12 cu. ft. per hour per customer. Lebanon, Pa., represents about one-sixth of 1% of Chicago and has a demand per customer of 19 cu. ft so that if these smaller companies can be taken as representative of what portions of the Chicago system would show, then sub-divisions of Chicago's distribution system would not show a very marked loss in diversity factor.

Fortunately, one member of the Committee has been able to set meters and actually measure the demand on certain sections of his distribution system. His

report of what he found is attached as Exhibit "A." It is interesting to note that the diversity factor applies almost as perfectly on as small a group of customers as 27 as it would on a whole property.

Exhibit "A"

Test No. 1 was made in a strictly residential section adjoining the City Line, and is occupied by families of a mixed class, in most cases being skilled mechanics and office employees, who are demanding gas in their kitchens exclusively in pretty nearly all cases. The main in the street selected is a 2″ main and is not tied in at both ends, thus enabling the test to be made from one direction. The main was entirely cut off and the gas by-passed through a "60 Lt. B" meter. The number of consumers connected are 34, the number of consumers using gas during the test being 27.

By reference to the record of this test, it will be seen that the meter registered a total consumption of 2400 cubic feet for the twenty-four hour period. You will note the readings began at 4:30 on the 4th of April and were for fifteen minute periods up to 5:45 p. m. These five readings show a consumption of 100 cubic feet for each of the 15 minute periods. At no time for the period was the demand greater than this.

This test showed the maximum demand per hour equal to 16 2/3% of the twenty-four hour consumption.

Test No. 2 was made at the Village, which is a small town built by the company. This Village has a total of 200 separate and distinct dwellings, each one of which is equipped with gas range in combination with a small coal burner on the side, and no doubt, the gas is used in pretty nearly every dwelling exclusively for cooking.

The gas mains throughout this village were laid with a view of further extensions, as this village is to be very much enlarged in the near future. The dwellings are all occupied by employees of the company, they being skilled mechanics, clerks and engineers. "60 Lt. B" meters were used in this test, the gas being by-passed by means of the gas supply being cut off with rubber bags, thus enabling us to pass all gas being used in this village through the meters and test at one time the whole consumption.

On the evening of the test, there were only five dwellings reported as not using gas.

I might add, in connection with this test, that five minute readings were taken to check the consumption down to a smaller period within the fifteen minute periods as shown on the accompanying tables. These five minute readings showed that we were getting in the fifteen minute readings the maximum for any period during the maximum hour.

The Test No. 3 was made in a district adjoining the City Line and which is very rapidly building up to the ordinary city conditions. In the street tested, there are 68 dwellings, all of which were connected to the main at the time of the test; there were 65 of these dwellings occupied and during the test 54 were using gas. Every one of these dwellings has nothing to cook with but gas. This main, as in the first test, is not tied at both ends, thus making the flow all in one direction.

It is interesting to note that the maximum consumption as shown by these tests during the maximum period never in any case, equaled twenty cubic feet.

The three points selected for these tests were chosen because of the fact that the dwellings, in most cases, are new ones, and are equipped for the modern use of gas in the home, with the possible exception of its use for house heating.

TEST NO. 1

WILDWOOD AVE., EAST LANSDOWNE

Size of Main—2″ Steel.
Length of Main—1150 feet.
Number of Consumers—34.
Number of Consumers using gas during Test—27.
Greater portion of dwellings equipped with gas kitchens. Meter used in Test "60 Lt. B."

Date	*Time*	*Meter Reading*	*Cu. Ft. Consumed*	*Pressure at Outlet of Meter*	*Pressure at End of Main*
4/3/23	6:30 P. M.	3283		2.9″	2.7″
4/4/23	4:30 P. M.	3301	1800	3.3″	3.0″
4/4/23	5:00 P. M.	3302	100	2.9″	2.0″
4/4/23	5:15 P. M.	3303	100	2.6″	2.0″
4/4/23	5:30 P. M.	3304	100	2.3″	1.7″
4/4/23	5:45 P. M.	3305	100	2.2″	1.5″
4/4/23	6:05 P. M.	3306	100	2.5″	1.9″
4/4/23	6:15 P. M.	3306.5	50	2.6″	2.3″
4/4/23	6:33 P. M.	3307	50	3.0″	2.5″

Total gas consumed in twenty-four hours, 2400 cubic feet.
Total gas consumed during max. hour, 400 cubic feet.
Maximum hour equaled 16-2/3% of twenty-four hour consumption.
Demand per lineal foot of main .3478.
Average consumption per consumer during max. hour, 11.76 cubic feet.
Average consumption per consumer using gas during test—15 cubic feet.
Average consumption for current month—1909 cubic feet.
Variation in consumption minimum 100 cubic feet, max. 4300 cubic feet.

TEST NO. 2

WESTINGHOUSE VILLAGE

Size of Mains 10″—6″—4″.
Length of Main 10″—735′, 6″—1214′, 4″—2035′
Number of Consumers—196.
Number of Consumers using gas during test—195.
All dwellings equipped with combination ranges.
Meters used in Test—5—"60 Lt. B's".

Date	*Time*	*Reading No. 1 Meter*	*Reading No. 2 Meter*	*Reading No. 3 Meter*	*Reading No. 4 Meter*	*Reading No. 5 Meter*	*Total Consumption*
5/15/23	4:45 P. M.	400	400	100	400	150	
5/15/23	5:00 P. M.	535	575	200	525	300	685 cu. ft.
5/15/23	5:15 P. M.	630	725	350	650	450	680 "
5/15/23	5:30 P. M.	835	900	500	850	650	930 "
5/15/23	5:45 P. M.	1000	1100	650	1000	800	815 "
5/15/23	6:00 P. M.	1100	1200	700	1125	900	475 "
5/15/23	6:15 P. M.	1200	1300	700	1225	900	300 "
5/15/23	6:30 P. M.	1300	1375	700	1300	900	250 "
5/15/23	6:45 P. M.	1325	1475	700	1300	900	125 "

Total gas consumed during test, 4,260 cubic feet.
Total consumption during max. hour, 3110 cubic feet.
Max. consumption per hour based on max. 15 min. period, 3720 cubic feet.
Demand per lineal foot of main, .9337 cubic feet.
Average consumption per consumer during max. hour, 19 cubic feet.
Average consumption per consumer using max. hour, 19.1 cubic feet.
Average consumption for current month, 2268 cubic feet.
Variation in consumption, minimum 300 cubic feet, max. 7400 cubic feet.

TEST NO. 3

OVERHILL ROAD UPPER DARBY—(STONEHURST)

Size of Main—4″ C. I.
Length of Main—1055 feet.
Number of consumers—65.
Numbers of consumers during test—54.
All dwellings equipped with Straight Gas Kitchens. Meter used in Test "60 Lt. B."

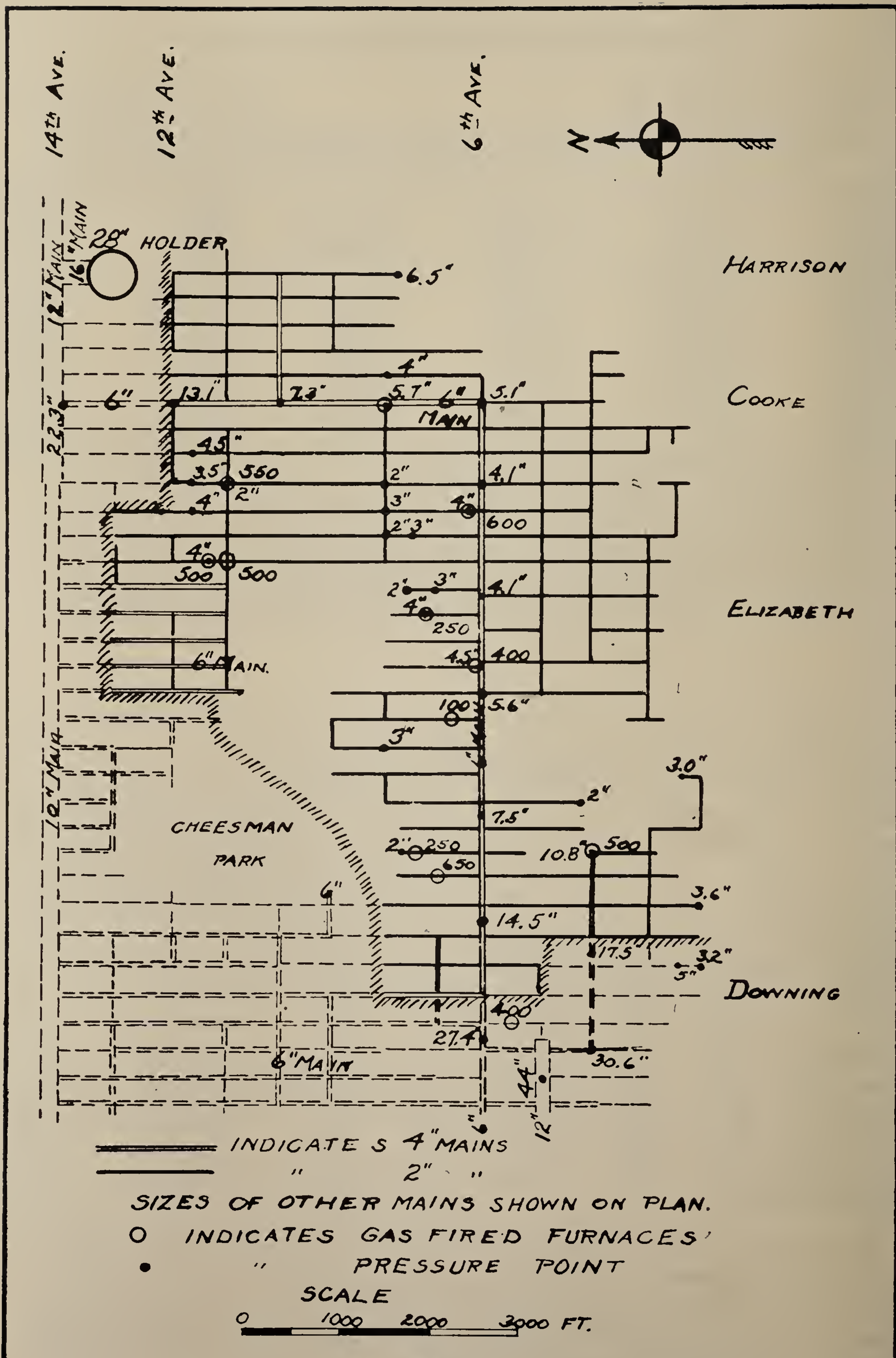
Date	*Time*	*Meter Reading*	*Cu. Ft. Consumed*	*Pressure at Outlet of Meter*	*Pressure at End of Main*
6/1/23	5:00 P. M.	2527			
6/1/23	5:15 P. M.	2527.5	50	2.8	2.4
6/1/23	5:30 P. M.	2529	150	2.6	2.3
6/1/23	5:45 P. M.	2531	200	2.5	2.1
6/1/23	6:00 P. M.	2533	200	2.3	1.9
6/1/23	6:15 P. M.	2535	200	2.5	2.1
6/1/23	6:30 P. M.	2537	200	3.0	2.7
6/1/23	6:41 P. M.	2538	100	3.2	2.9
6/1/23	6:45 P. M.	2538.25	25	3.3	2.9

Total gas consumed during test, 1125 cubic feet.
Total gas consumed during max. hour, 800 cubic feet.
Max. consumption per hour based max. 15 min. period, 800 cubic feet.
Demand per lineal foot of main, 7582 cubic feet.
Average consumption per consumer during max. hour, 12.5 cubic feet.
Average consumption per consumer using max. hour, 14.8 cubic feet.
Average consumption for current month, 1500 cubic feet.
Variation in consumption, minimum 400 cubic feet, max. 3300 cubic feet.

In another city there is a section of the distribution system which has been laid out, using 2 inch mains almost exclusively. This section of the city is shown on map B. It shows a bookkeeping district. The total length of mains is about 120,000 feet of which 85 per cent is 2 inch pipe. The sales in this bookkeeping district in the maximum month were 11,621,000 cu. ft. and there were 2,600 customers, making the monthly sales 4,500 cubic feet per customer. The average sales for the whole company in that month was 3,500 cu. ft. per customer, so that the customers in this district are above the average for the company.

The demand in this bookkeeping district is somewhat more than 60,000 cu. ft. per hour, making the maximum demand per foot of main .50, and the maximum simultaneous demand per customer 24 cu. feet. There is also shown on the map by circles househeating installations, and the measured demand of each such installation is also shown in cubic feet per hour. Finally, the pressures obtaining at the peak of the load are shown in inches of water in various parts of the system. How great the capacity of these 2 inch mains is cannot be appreciated until we take into account the following conditions:

1. The high pressure shown on this map is not necessitated on account of the 2 inch. The high pressure in this case is necessitated by the lack of capacity in the mains larger than 2 inch. For example, in the upper right hand corner on Cooke Street we have 22 inches of pressure on 14th Avenue and only 13 inches on 12th Avenue, or 9 inches loss in about 1,200 feet. Likewise, on 6th Avenue, you will note in


14th Ave.
12th Ave.
6th Ave.
N
28" HOLDER
12" MAIN
16" MAIN
HARRISON
COOKE
ELIZABETH
DOWNING
CHEESMAN PARK
6" MAIN.
6" MAIN
12" MAIN
INDICATES 4" MAINS
" 2" "
SIZES OF OTHER MAINS SHOWN ON PLAN.
O INDICATES GAS FIRED FURNACES
• " PRESSURE POINT
SCALE
0 1000 2000 3000 FT.

Map B

about 1,200 feet we have lost 13 inches of pressure in this 6 inch main.

2. You will note that substantially all of the 2 inch is supplied from the larger mains at a very nominal pressure of 4 or 5 inches.

3. For the great majority of 2 inch mains very modest differential pressures prevail; for example, 4 or 5 inches initial to 2 inches minimum.

4. Please note that there are a number of househeating installations on these 2 inch mains, indicated by a circle. The one on 7th and Elizabeth has been heating his house with gas for seven years.

5. If the 6 inch main were replaced with 10 inch, the drop in pressure along this main would be reduced 93 per cent in each case, so that we would require at 12th and Cooke less than 5 inches, and at 6th and Downing about 5.3 inches.

6. It has not been necessary to tie these 2 inch together at every cross street or to eliminate dead ends.

7. This district is still largely without service regulators. Those portions, however, suffering from the highest pressures which originated on the 6 inch main feeding the district, have been provided with regulators. Their necessity, however, would disappear if the 6 inch main were replaced with 10 inch and the pressure reduced, as outlined in 5 above.

This actual installation should be compared with table 3 in last year's paper, which is reproduced here for reference as table C. The following table shows a comparison of the principal features of the system outlined in that paper and the actual system shown on this map.

TABLE C

	Blocks From End of Feeder	Cubic Feet Flow	Feeder Size	Pressure Drop in that Block	Total Pressure Drop	Pressure Drop Per 1000 Ft.	Total Length of Feeders	Total Cost of Feeders	Total Length of Distributors	Total Cost of Distributors	Total Cost of System	Cost Per 1000 ft. Demand	Square Miles	Cost Per Square Mile
2″ distributors	1	1785	6	.012	.012	.033	370	$ 580	4200	$ 1802	$ 2382	$1337	.056	$42600
.425 cu. ft. flow per	2	3570	6	.048	.060	.131	740	1160	8400	3604	4764	1337	.112	42600
ft. of distributors	3	5355	8	.025	.085	.067	1110	1975	12600	5406	7381	1377	.168	43800
2″ pressure drop	4	7140	8	.044	.129	.118	1480	2790	16800	7208	9998	1398	.224	44600
in distributors	5	8925	8	.067	.196	.185	1850	3605	21000	9010	12615	1415	.280	45100
1″ pres. drop per	6	10710	10	.031	.227	.084	2220	4625	25200	10812	15437	1442	.336	46000
1000 ft. of Feeder	7	12495	10	.042	.269	.114	2590	5645	29400	12614	18259	1462	.392	46600
	8	14280	10	.055	.324	.149	2960	6665	33600	14416	21081	1476	.448	47100
	9	16065	12	.027	.351	.074	3330	7935	37800	16218	24153	1502	.504	47900
	10	17850	12	.034	.385	.091	3700	9205	42000	18020	27225	1526	.560	48700

Avg. = .105″ per 1000 = .55″ per Mile

	Last Year's Paper Table 3	Actual
Length of 2″ between feeders	4200′	4700′
Minimum pressure on 2″	2″	2″
Minimum feeder pressure	4″	4″
Demand per foot of main	.425	.50

You will note by looking at this table that the distance between feeders is as great as outlined in that table, that the drop in pressure is substantially the same, that the demand per foot is somewhat greater and therefore that whatever estimates were made regarding diversity factor, in preparing the table in last year's paper, were justified in actual practice.

Another case should be discussed because the analysis we present here will perhaps give some distribution engineers a confidence to use cheaper designs which otherwise they perhaps would not feel justified in asserting. In a certain city the demands were estimated from the monthly consumption in four cases as follows:

Case	*Demand per foot of main*
A	1.42
B	1.70
C	2.82
D	5.26

While these demands per foot of main have been estimated they nevertheless bear about the same relation to the consumption that exists in other cases and are probably about correct. These demands are so much higher than the demand in table 3 of last year's paper (repeated here as table C) that the distribution system outlined in that table would not apply. However, it can be shown as follows that these four cases are not typical of any large part of the distribution system. Since they were estimated from the monthly consumption we can make the following table from the monthly consumption figures:

Case	*Sales per ft. of main per month*
A	243
B	293
C	493
D	931
Total Company Average	131

This shows that the four cases selected are all much above the average and if any considerable part of the distribution system is assumed as represented by these four cases, then the balance must have an extremely small sales per foot.

If we assign arbitrary percentages to these four cases we make the following table:

Case	Monthly Cu. Ft. Sales per ft. of Main	Percentage Represented	Contribution to the Average
A	243	6	14.58
B	293	6	17.58
C	493	3	14.79
D	931	3	27.93
		18	74.88
Balance of Co.	68 Calculated	82	56.12
Total Company Average	131	100	131.00

This shows that 82% of the distribution system has a monthly sales per foot of main of 68, which is about half the average for the whole Company. If the demand per foot of main bears the same relation to the sales in this 82% of the distribution system as in the other 18%, as seems to be reasonable from a study of the table submitted in last year's paper, then the maximum demand per foot for this 82% of the distribution system will be .39 cu. ft. per hour per foot of main, which could certainly be handled on a distribution system like the one outlined on the map referred to above or in last year's paper. Therefore, 82% of this company's distribution system could be built of the cheaper design.

One point in last year's paper seems to be overlooked namely that table 3,

TABLE "D"

Size of Distributors	*Pressure Drop in Distribution*	*Press Drop M' Feeders*	*Demand Cu. Ft. Per Ft.*	*Cost Sq. Mi.*
2″	2″	1/10	.2125	$ 41,000
2″	2″	1/10	.425	48,700
2″	2″	1/10	.85	60,000
2″	2″	1/10	1.7	84,000
4″	2″	1/10	1.7	115,000
2″	2″	1/10	3.4	130,000
4″	2″	1/10	3.4	140,000
2″	2″	1/10	6.8	210,000
4″	2″	1/10	6.8	178,000
6″	2″	1/10	6.8	186,000
4″	2″	1/10	13.6	254,000
6″	2″	1/10	13.6	246,000

which is reproduced here (as table C) is only one of a series of tables. To emphasize this point we submit the following table D in which you will note that there are 12 tables No. 3 computed, only the second one of which was selected for exhibition. Some of these tables you will note were computed for much heavier demands than table 3. Some of these demands are large enough to take care of case "D" above. Please note also that these tables were made up not only for 2 inch but for other sizes of distribution mains, and that the pressure conditions were just as severe on one size as on the others. In other words, *if one size could not give service under the conditions assumed, the others could not either.*

The determination of demands from actual readings does not seem to be as common to gas men as it should be, the electric distribution men have portable instruments with which in a very short time they can readily read the actual demand on any line. The gas man, however, has been considerably handicapped because he had no such instruments. However, one company has used a method which, while not as accurate as the electrical distribution man's method, is at least accurate enough to give very valuable information. The scheme is to take the drop in pressure on mains and compute from well known flow formulae the hourly rate at which the gas flows. It is open to the objection, of course, that there may be deposits or stoppages in the mains but for this particular purpose all such stoppages will only tend to make the demand appear greater than it really is and no abnormal condition could make the readings lower than the actual. The instructions sent out by this company for the taking of such pressure readings are attached to this report. (Exhibit E.)

Exhibit "E"

NOTES ON TAKING PRESSURES

I. The only satisfactory instrument is the "U" Gauge. One advantage of this apparatus is that it is always accurate and another is that the cheapest one is just as accurate as the most expensive one.

II. It is useless to try to fill the tube just to the zero mark, because:

1. It is very difficult to fill a gauge exactly to a mark and make it stay there.

2. Twice the reading on one leg is not always the same as the sum of the reading on both legs, and the latter is correct.

III. Only water should be used in the tube as other liquids do not give the same reading. For example, when the true pressure is thirty tenths, the gauge using water will show thirty tenths or three inches, while the gauge using kerosene will show from thirty-six to thirty-nine tenths, depending upon the grade of kerosene used, and the temperature, and the gauge using glycerine will show twenty-three or twenty-four tenths. In case pressures must be read where water would freeze, the gauge should be filled with kerosene or glycerine. After the pressures have been read the gauge should be taken to a warmer place and connected up with a gauge filled with water and by manipulating the pressure, the water pressure corresponding to each reading on the glycerine (or kerosene) gauge can be read off.

IV. Satisfactory main pressures can be taken at the consumer's appliance as follows:

1. The gauge is attached to some idle burner and a reading taken.

2. Then all the other burners are shut off for a moment while a second reading is taken.

3. Then they are re-lighted and the consumer has the use of the appliance.

The first reading will be, say, thirty tenths, and the second reading thirty-three tenths. The second reading is the true pressure in the main. So long as the burners are on as at first the gauge will read three tenths too low, and each reading should be corrected accordingly.

V. In making a careful survey of pressures it is often necessary to take into account the difference in elevation of the several points where the pressure readings are taken. The pressure reading increases one tenth for every fifteen feet of rise. A very convenient way to take care of this is to get the more important street elevations from the city engineer, find the difference in elevation from the gas works and divide by 15. This gives the increase in pressure due to elevation alone.

VI. When the business grows so that too much pressure is lost it is very necessary that a series of pressures be taken along the line of feed from the works. The pressure as it exists at the moment of most rapid flow must be known at each point on the line of feed where the size of main changes, or a large branch is taken off. This information, corrected for the elevation, will often indicate a single block of main where the whole trouble is located.

VII. In order to know whether a main is obstructed by naphthalene, or scale, etc., it is necessary to know the size, length and pressures, and also the quantity of gas. The proper method of getting the rate of gas flow from the works is as follows:

Read the station meter at intervals, say every fifteen minutes, and at the same time read the height of the holder. If the holder is falling then the amount of gas represented by the fall of the holder between two readings plus the amount of gas registered on the meter for the same interval is the total gas

delivered to the mains during that interval. These amounts plotted on cross-section paper make a "load-curve."

VIII. In following up the pressure conditions in a gas main the method described below has given good results. Let it be assumed that the main under discussion runs along Main Street and crosses Avenues "A," "B," "C," etc. Pressures are taken at Avenue "A," where the main leaves some larger main, or the works, and at Avenue "D," where a large branch comes off. A man is stationed at "A" with a gauge and a watch and makes a reading at the hour and every fifteen minutes thereafter during the peak, say, five readings. Another man at "D" with a watch, set by the first one, also reads every 15 minutes and at the same moment as the readings are taken at "A." The "D" pressures subtracted from the "A" pressures give the pressure lost at each fifteen minutes. To the pressure losses must be added the equivalent in difference in elevation as explained in Note "V." This correction should be added to the pressure loss if the gas flows up-hill and subtracted if the gas flows down-hill. The time when the corrected pressure loss is greatest is the time of greatest demand on this main. This may not occur at the same time as the maximum demand on the works.

If it is desired to continue the investigation farther up the main, the men will be stationed at "D" and "G" or "H," the following evening and take a new series of readings. In selecting evenings to take such pressures, it is necessary to eliminate days of light demand, for example, Sundays. It may happen that the tax on the main is most severe on Saturday evening of each week. In that case it may be necessary to take readings at "A" and "D" on this Saturday and at "D" and "H" on the following Saturday.

In case the peak hour at the plant varies considerably from day to day it may be necessary to correct the pressure losses to some standard. The pressure losses vary as the square of the rate, but it is sufficiently accurate to say that any change of rate expressed in per cent faster or slower makes the pressure loss increase or decrease just twice as many per cent.

For example: If the rate of flow increases 10% the pressure drop will increase 20%. In the above case if the peak hour was 8% less while the "D" to "H" readings were taken than while the "A" to "D" readings were taken, the pressure losses figured from the "D" to "H" readings after being corrected for elevation would be increased 16%. They would then compare with the "A" to "D" readings.

IX. If the men are not familiar with the methods in Notes IV and VIII, it may be well to put them in adjoining rooms or buildings where the pressures should be the same and see if they get identical readings.

X. The accompanying table will permit checking up gas mains.

The pressure drop is given for 1,000 feet of pipe.

If the length of pipe under study is half as long, or twice as long, the pressure loss will be half as much or twice as much, respectively.

With the table one can check up the sections "A" to "D," described in Note VIII with section "D" to "H" as to whether the pressures correspond with the probable amounts of gas flowing.

PRESSURE DROP

In Inches of Water Per 1000 Feet in Various Sizes of Pipe

Cubic Feet Per Hour	½″	¾″	1″	1¼″	1½″	2″	2½″	⅜″
5	0.069	0.013	0.003	——	——	——	——	0.278
6	0.100	0.018	0.005	0.001	——	——	——	0.400
8	0.178	0.033	0.008	0.002	——	——	——	0.711
10	0.278	0.051	0.013	0.003	0.001	——	——	1.110
15	0.626	0.115	0.029	0.007	0.003	——	——	2.500
20	1.110	0.204	0.051	0.012	0.005	0.001	——	4.450
30	2.500	0.460	0.115	0.026	0.010	0.003	0.001	10.000
40	4.500	0.818	0.204	0.046	0.019	0.006	0.002	**3″**
50	6.950	1.278	0.320	0.072	0.029	0.009	0.003	0.001
60	10.000	1.840	0.460	0.103	0.042	0.012	0.004	0.001
80	17.800	3.260	0.818	0.185	0.074	0.022	0.007	0.002
100	**4″**	5.100	1.278	0.287	0.116	0.035	0.012	0.004
150	0.002	11.500	2.870	0.646	0.260	0.078	0.026	0.008
200	0.004	**4½″**	5.100	1.150	0.460	0.138	0.046	0.014
300	0.008	0.004	11.495	2.580	1.040	0.311	0.104	0.032
400	0.014	0.007	**5″**	4.590	1.850	0.550	0.185	0.057
500	0.022	0.012	0.007	7.180	2.880	0.865	0.287	0.089
600	0.032	0.017	0.010	**6″**	4.160	1.240	0.415	0.130
800	0.056	0.030	0.017	0.007	7.400	2.220	0.735	0.230
1000	0.088	0.046	0.027	0.010	11.590	3.460	1.150	0.360
1500	0.197	0.104	0.061	0.023	**7″**	7.780	2.590	0.800
2000	0.350	0.186	0.108	0.041	0.019	13.830	4.610	1.450
3000	0.785	0.418	0.242	0.093	0.042	**8″**	10.350	3.200
4000	1.400	0.741	0.430	0.165	0.074	0.037	**9″**	5.700
5000	2.180	1.160	0.672	0.257	0.116	0.058	0.031	8.900
6000	3.150	1.670	0.968	0.370	0.167	0.084	0.045	12.820
8000	5.610	2.960	1.720	0.658	0.296	0.148	0.082	**10″**
10000	**12″**	4.630	2.680	1.028	0.462	0.233	0.126	0.073
15000	0.064	10.420	6.050	2.318	1.041	0.521	0.284	0.165
20000	0.115	**16″**	10.750	4.120	1.850	0.928	0.502	0.292
30000	0.258	0.060	**20″**	9.250	4.160	2.080	1.130	0.655
40000	0.458	0.106	0.034	**24″**	7.400	3.710	2.010	1.170
50000	0.716	0.166	0.054	0.021	11.580	5.800	3.140	1.825
60000	1.030	0.240	0.078	0.030	**30″**	8.350	4.520	2.625
80000	1.830	0.426	0.138	0.054	0.017	**36″**	8.050	4.675
100000	2.860	0.664	0.216	0.084	0.027	0.011	12.600	7.300
150000	6.440	1.500	0.484	0.190	0.061	0.024	**42″**	16.495
200000	11.450	2.660	0.861	0.337	0.109	0.043	0.020	**48″**
300000	25.800	5.980	1.946	0.760	0.245	0.097	0.045	0.023
400000	45.800	10.620	3.441	1.350	0.435	0.172	0.080	0.041
500000	71.600	16.620	5.380	2.110	0.680	0.269	0.124	0.065
600000	103.000	24.000	7.748	3.040	0.975	0.386	0.178	0.093
800000	183.000	42.600	13.800	5.400	1.740	0.690	0.316	0.165
1000000	286.000	66.400	21.600	8.415	2.715	1.073	0.495	0.258

In regard to the relative durability of steel and cast iron mains, we find some interesting data. One company reports the following on services:

Service Fittings	*Size*	*No.*
Services Rusted Out	1″	29
	1¼″	448
	1½″	11
	2″	10
	2½″	1
	3″	1
	1¼″	15

Service Fittings	*Size*	*No.*
	2″	1
	2½″	1
Services Rusted by Electrolysis	1¼″	31
	1½″	2
	2″	2
Services Rusted Out-Soil Corrosion	1¼″	2
	2″	1
Stub Services Rusted Out	¾″	2
	1¼″	3
Services Broken by Graders	1¼″	8
	1½″	3
		571 571

Service Fittings	*Size*	*No.*	
Services Broken at Cock	1¼"	2	
	1½"	2	
Core Loose	1¼"	10	
	1½"	1	
Long Screws Rusted Out	1¼"	3	
	1½"	1	
Nipple on Service Split	1¼"	1	
Service Split in Seam	1¼"	1	
	1½"	1	
		22	22
Street Ells Split	1¼"	3	
	1½"	3	
Street Ells Broken at Main	1½"	4	
Street Ells Rusted Out	1¼"	2	
Street Tee Broken at Main	1¼"	2	
Street Tee Split	1¼"	6	
Plain Tee Rusted Out	1¼"	1	
Plain Tee Split	1½"	1	
		22	22
			615

In this comparison there are 22 leaks out of 615, or 3% in the cast iron portion of the structure and the balance in the steel portion.

Since the service is probably at least 40 ft. long and the cast fittings do not represent an actual length of more than 8 inches, it is evident that less than 2% of the service length is of cast material. In other words, this table shows that 3% of the leaks occurred on the cast portion of the service, representing less than 2% of the length of the service. Apparently steel is more durable than cast material. At any rate this certainly does not prove that steel is less durable than cast iron.

From another source we get the following data:

INSTALLATION AND REPLACEMENT OF TWO-INCH MAINS

Year	*Installed—Feet*	*Replaced*	*Reasons and Comments*
1913	45,314		No record of replacements
1914	39,067		No record of replacements
1915	22,135		No record of replacements
1916	24,536	3,165	New York Operating Report
1917	28,314	384	New York Operating Report

Note: The above record of replacements is undoubtedly very inaccurate and incomplete. The only record for this period is the New York report, and it is very probable that no entries were made showing two-inch pipe when replaced by two inch.

Year	*Installed*	*Removed*	*Replaced By*	*Reasons and Comments*
1918	14,734	2,150	2 in.	Badly corroded by electrolysis
1919	19,100	2,650	2 "	Badly corroded by electrolysis
		745	4 "	Fair condition—20% salvage
1920	29,405	550	2 "	Badly corroded—alkali soil
		500	2 "	" " by electrolysis
1921	13,594	3,000	2 "	" " alkali soil and ashes
		900	2 "	" " by electrolysis
1922	40,112	1,300	2 "	" " by electrolysis
		400	4 "	" " filled soil—ashes
		1,550	2 "	" " alkali soil

Note: The above record of replacements is from the memory of the Superintendent of Distribution of particular jobs during the time in which he has handled this work. In addition to the above, there were numerous small jobs of from fifty to one hundred feet of two-inch pipe replaced. We have been unable to find any records of any of these replacements except those in which the two-inch pipe was replaced by large pipe. Much of the above replacement was due to bad soil conditions where there is filled ground with ashes. Also in certain sections of the City chiefly at points adjacent to street railway sub-stations, electrolytic conditions are very bad. In one of these locations on Monroe Street, between Fifteenth and Seventeenth Avenues, 1300 feet of main and all services have been replaced twice in the past five years.

INSTALLATION AND REPLACEMENT OF TWO-INCH MAINS, NO. 2

Date	*Size*	*Length*	*Replaced With*	*Reason, Condition and Remarks*
1923				
Jan. 2	2″	345	2″	Electrolysis—no salvage
" 4	2″	480	2″	Electrolysis—no salvage
" 30	1½″	165	2″	Bad condition
Mar. 3	2″	6	2″	Electrolysis—no salvage
" 5	1½″	140	2″	Bad condition
" 6	2″	1,449	6″	Fair condition—50% salvage
" 8	2″	1,077	2″	Bad electrolysis—no salvage
" 10	1¼″	156	2″	Bad condition—no salvage
" 20	2″	825	10″	Bad condition—no salvage
" 25	2″	500	4″	Fair condition—50% salvage

Note: Beginning the first of this year, all maintenance work on mains is being kept on Miscellaneous Work Orders, which are filed and a careful record will be kept of all replacements and repairs.
Total two-inch main laid to May 1, 1923, 14,190 feet.

This shows a total of 22,440 feet of 2″ pipe replaced. Two-inch pipe began to be laid in 1903, and by 1913, 162 miles had been laid. Assuming that the replacements applied to none of the main laid since 1913, the 22,000 feet represents 140′ per mile replaced in a period of about seven years, or at the rate of 20′ annually per mile of 2″, which is less than .4% of one per cent.

Any suspicion that this data is incomplete can be tested from the following facts, about which there can be no question.

The total expenditure for street main maintenance for the ten years beginning 1913 was $38,302, or at the rate of $3,830 per year. A part of this expenditure was for maintenance of cast iron mains larger than 2 inch. However, if we assume that it applies only to the 2 inch in service in 1913, namely 162 miles, we find that this $3,830 per year represents only one per cent on the 162 miles of 2 inch.

From another source we received further data shown as Exhibit F.

Exhibit "F"

The total length of steel and wrought iron pipe in our main system totaled on January 1st, 1923, 1,299,987 feet. You will note by reference that the pipe removed since 1903, due entirely to electrolysis, totals 27,646 feet, which is a little more than 1 1/3% of the total steel and wrought iron pipe in use on January 1st, 1923.

Referring to the pipe removed due to other causes than electrolysis it will be noted that a total of 47,006 feet, or a little more than 3.6% was removed. The latter renewals being maining due to the necessity of putting our mains in the proper condition ahead of paving.

You will note there has been some 3½, 5 and 7 inch wrought iron mains removed, this being in each instance acquired mains, the year of their installation not being known, but it is presumed that they were in the ground at least 30 years previous to removal. The reason for their removal was due to the fact that, in most cases, when the streets were to be paved with a concrete paving, they were examined and found to have deteriorated considerably from combination of soil and electrolysis corrosion, which made it seem better to make these renewals rather than to run the risk of leaks in the near future.

Previous to 1913, we were purchasing pipe which was supposed to be wrought iron pipe for all high pressure work.

Since that time however, we have substituted steel pipe.

In considering these tables, the following points should be taken into consideration.

1. Our company has been working on the lines of mitigation of electrolysis conditions since 1905. This has probably reduced our loss due to this cause very materially.

2. The pipe loss does not show the total of electrolysis troubles, as a great number of our leaks have been repaired by the use of blank saddles, thus removing, in these instances, the necessity of pipe renewals.

3. The pipe loss as shown, does not represent any service loss as we do not keep an account of the pipe loss by renewal of service; this, however, would make very little difference in the total footage as shown.

4. There is, no doubt, a considerable amount of pipe that is very much corroded, and which may increase somewhat, the percentage of our losses within the next few years over and above that as shown herein.

Our records do not show that any cast iron pipe has been removed due to electrolysis corrosion, nor does any service taken from cast iron pipe laid with cement joints, show any electrolysis corrosion so far as it is known to date.

You will note under cast iron pipe removed for the year 1903 a considerable amount of 8″ pipe removed. This was necessitated by the company at that time wishing to run a 16″ trunk line on this street, necessitating the removal of this 8″ pipe.

I am also giving a table, herewith, showing the leak repairs for the period of 1921 and 1922, which is typical also of previous years. This, also, shows a very low percentage of repair cost against the total value of main and service installation.

The results, as shown in my analysis as given, were somewhat surprising to me; having gone over these figures in the careful manner in which I have done to get this information, it led me to believe the percentage of loss would be very much higher than here shown. I believe that, if figures were available in order to analyze the loss of other companies, they would find, no doubt, that the amount of their losses would not be nearly so great as they think they are.

LEAKS—1921 and 1922

Year	*Electrolysis*	*Rusted Through Wall*	*Destroyed by Cinders*	*Rusted From Age*	*All Other Causes*	*Total*
1921	72	10	9	14	61	166
1922	63	24	4	29	70	190

PIPE RENEWAL—¾″

Year Laid	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	*Totals*
1901		138			111	190						80			519
1903							154	208							362
1905						100									100
1909										208					208
1915								411							411
Totals		138			111	290	154	619		208		80			1600

Year Laid	1906	1910	1912	1913	1914	1915	1916	1917	1918	1919	1920	1922	1923	1921	*Totals*
							1¼″								
Acquired													155		155
1900				920	333			236							1489
1901				653	685							80			1418
1902		55	735		129	78		621					297	65	1980
1903			3040		692			19		398				349	4498
1904		153	257		617		389	519	145						2080
1905			72		209										281
1907								20							20
1908			1756												1756
1909					272							242			514
1910					419										419
1911					141										141
1912					27										27
1913								604							604
Total		208	5860	1573	3524	78	389	2019	145	398		322	452	414	15382
							1½″								
1902		100										338			438
1904	162														162
1913								92	283			512			887
1916								23						240	263
Total	162	100						115	283			850		240	1750
							2″								
Acquired	400		890				31								1321
1899			287												287
1901		20													20
1903								288		282					570
1904														45	45
1905		137						167							304
1906	150	71	57	183	17								13		491
1907	257	24		392				2322				153			3148
1908								1454							1454
1909								1986		80		1257			3323
1910														42	42
1913												3561			3561
1915								109							109
1920													88		88
Totals	807	252	1234	575	17		31	6326		362		4971	101	87	14763
							3″ W								
1900								2008							2008
1906				48	229										277
1907								290							290
1914														87	87
Totals				48	229			2298						87	2662
							3½″ W								
Acquired		20	56	356	176	319		1882				414		169	3392
							4″								
Acquired					556		21			353					930
1899						218									218
1900								83							83
1902			40			26		1830	1054						2950
1903					53									50	103
1906								884	1093						1977
1911							40								40
1913							203								203
Totals			40		609	244	264	2797	2147	353				50	6504
							5″								
Acquired		153			78				722						953
			GRAND TOTAL												47006

2″

Year Laid	1906	1910	1912	1913	1914	1915	1916	1917	1918	1919	1920	1922	1923	1921	Totals
1900	1357														1357
1909							205				162				367
1910							249								249
1912														203	203
1913										132					132
1914											132				132
1916										118	50				168
1918											29				29
1919										163					163
Totals	1357						454			413	373			203	2800
							3″								
1900														59	59
1902										88					88
1907									347						347
Totals									347	88				59	494
							4″								
1902					355		742			1280			3750		6127
							6″								
1902							520								520

STEEL AND WROUGHT MAINS DESTROYED BY ELECTROLYSIS

¾″

Year Laid	1903	1906	1910	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	Totals
1900					264							107	177		548
1901			14		110			217			132				473
1902			106		173						221				500
1903									59				157		216
1904											137				137
1905											20				20
1906						423									423
1908													63		63
1909									376						376
Totals			120		547	423		217	435		510	107	397		2756
							1¼″								
1901	348		1382					195							1925
1902							1392							106	1498
1903							393	330		179	875	56	1350	36	3219
1904														122	122
1905									485					90	575
1906										127					127
1907													78		78
1908						316							210		526
1909								831			163	88			1082
1910							200	138			18	88		88	532
1913									148		46				194
1917													75		75
1920													134		134
Totals	348		1382			316	1885	1494	633	306	1102	232	1847	442	10,187
1900	56														56
1909					2934										2934
1912												141			141
1913						535		129							664
1914								501					137		638
1915									137						137
1916														137	137
1920												55			55
Totals	56				2934	535		630	137			196	137	137	4762

CAST IRON PIPE REMOVED

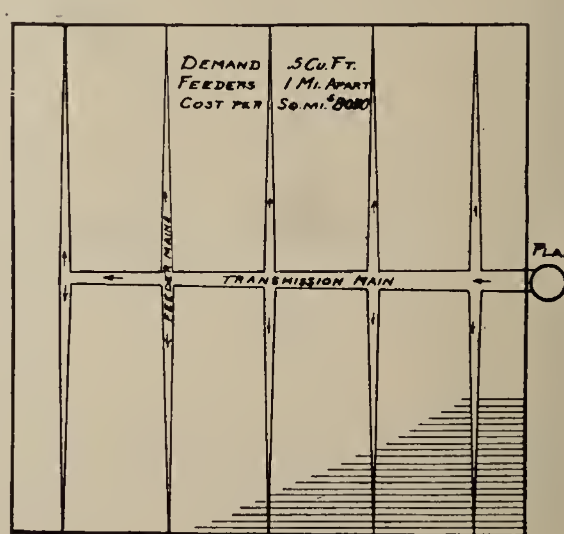
2″ C. I.

Year *Laid*	1903	1910	1911	1912	1913	1914	1916	1917	1918	1920	1921	1922	*Totals*
Acquired		300	350			540			1085		520	714	3509
3″ C. I.													
Acquired		4580	1998		1341	253	102	519	.	392		608	9793
4″ C. I.													
Acquired								1005					1005
1911				23	339								362
Totals													1367
8″ C. I.													
1902	1080												1080

You will note in this that 75,000 feet have been renewed in twenty years or an average of less than 4000 feet per year, with a total length of about 1,300,000 feet, representing an annual replacement of less than .3 of 1% per year.

Some of the discussion following last year's paper indicates that some engineers assume that, if two-inch pipe is used, high pressure must of necessity be utilized to make it serviceable. The distribution design described in last year's paper is, nevertheless, a low pressure design. There is an economy, however, in going to higher pressures and to determine just how high a pressure should be utilized and just what the relative economy of different distribution designs would be, there is presented here a series of high pressure designs, for various demands, using different size distribution mains and in all cases utilizing the pressures which would make the system a minimum cost. These are shown in table G. For this study, an area of substantially 5 miles square was assumed, the manufacturing plant being on one side as shown on Map H.

Because the different size pipes are most economical with different pressure drops per thousand feet, the total pressure required on these distribution systems is not always the same, and, therefore, it is necessary to compare the different systems on an annual cost basis of which the annual cost of pumping is a part.



Map H

This table G permits us to draw a number of general conclusions. In the first place, 2 inch is more economical than 1¼ inch for demands greater than 1 foot per lineal foot, and more eco-

TABLE G

Dist. Bet. Feeders	Size Distributors	Cu. Ft. Demand Per Lineal Ft.	Pressure Drop in Distributors	Press. Drop Feeders	Press. Drop Transmission	Total Drop	Pumping Cost Per Year	Cost of Dist. Per Year	Cost Feeder Per Year	Cost Transmission Per Year	Total System Cost Per Year	Total Cost Per Year	Area Square Miles	Total Cost Year Per Sq. Mile
½ Mile	1¼″	.5	5.5″	145.8″	103.9″	255.2″	$ 42900	$ 86200	$ 49400	$ 25900	$ 161500	$ 204400	25.0	$ 8180
1 "	1¼″	.5	44.2	118.9	93.5	256.6	43000	86200	34000	23930	144130	187130	25.0	7470
1½ "	1¼″	.5	215.5	109.1	78.5	403.1	60650	77400	25000	20000	122400	183050	22.5	8150
1 "	2″	.5	5.3	118.9	93.5	217.7	36550	110500	34050	23870	168420	204970	25.0	8030
1½ "	2″ -	.5	17.9	109.1	78.5	205.5	32500	99500	25000	20000	144500	177000	22.5	7860
2 "	2″	.5	42.5	102.5	70.0	215.1	43300	133000	29000	36500	198500	241800	30.0	8070
¼ "	1¼″	2.0	11.1	122.4	67.1	200.9	134800	86000	136000	67000	289000	423800	25.0	16900
⅜ "	1¼″	2.0	37.1	112.6	73.1	222.8	145800	84000	107800	64200	256000	401800	24.3	16500
⅝ "	1¼″	2.0	171.5	68.8	59.8	300.1	200500	86000	89400	70600	246000	446500	25.0	17750
⅜ "	2″	2.0	4.5	112.6	73.1	190.2	124500	107700	107850	64250	279800	404300	24.4	16550
⅝ "	2″	2.0	20.6	68.8	59.8	149.2	102720	110500	90000	70370	270870	373590	25.0	14940
⅞ "	2″	2.0	56.7	70.3	68.6	195.6	138000	115950	64800	72640	253390	491390	26.2	18760
⅛ "	1¼″	4.0	5.5	121.9	71.4	198.4	268500	85000	272800	104200	462000	730500	25.0	29200
¼ "	1¼″	4.0	44.3	95.5	68.7	208.5	279100	85000	197600	103000	385600	664700	25.0	26600
⅜ "	1¼″	4.0	148.5	86.8	74.7	310.0	402800	84200	155850	96450	336500	739300	24.4	30300
¼ "	2″	4.0	5.3	95.5	68.7	169.5	228000	110500	197600	104434	412534	640534	25.0	25600
⅜ "	2″	4.0	17.9	86.8	74.7	179.4	238200	107664	155870	96450	359984	594684	24.4	23700
½ "	2″	4.0	42.3	65.2	69.2	176.7	237500	110500	147613	101880	359993	597493	25.0	23900
½ "	4″	4.0	1.1	65.2	69.2	135.5	183300	296350	147740	101910	546000	729300	25.0	29100
⅝ "	4″	4.0	2.1	67.8	64.7	134.6	183300	296350	132100	104550	533000	716300	25.0	28600
¾ "	4″	4.0	3.7	63.7	72.9	140.3	202000	313500	132650	114250	560000	762000	26.25	29000
⅛ "	2″	8.0	2.5	80.0	59.7	142.0	384000	110500	390414	183412	684326	1068326	25.0	42200
¼ "	2″	8.0	21.2	66.0	61.5	148.7	401000	110500	295425	181287	587212	998212	25.0	39590
⅜ "	2″	8.0	71.5	64.6	55.8	191.8	501500	110000	243784	176388	530172	1031672	24.4	42300
⅜ "	4″	8.0	1.8	64.6	55.8	122.2	322700	289000	243000	175000	707000	1029700	24.4	42200
½ "	4″	8.0	4.3	57.3	56.5	118.1	320500	296000	176450	181650	654100	974600	25.0	39000
⅝ "	4″	8.0	8.4	50.5	54.7	113.6	317000	296000	211000	180000	687000	1004000	25.0	40100
1/16 "	2″	16 0												
⅛ "	2″	16.0	10.6	68.0	45.0	123.6	672000	110500	584000	297940	992440	1664440	25.0	66600
¼ "	2″	16.0	84.5	58.3	45.3	188.1	1010400	110500	445230	284700	840430	1850830	25.0	74030
⅜ "	4″	16.0	7.2	55.7	38.1	101.0	536000	289000	378000	287000	954000	1490000	24.4	61300
½ "	4″	16.0	17.1	44.1	44.5	105.7	573600	296000	361000	294000	951000	1524600	25.0	61000
⅝ "	4″	16.0	33.5	44.0	42.7	120.2	652000	296000	331900	291600	919500	1571500	25.0	62900

Compiled by F. P. Kerr and L. F. Babcock
June 1st, 1923

nomical than either 1¼ or 4 inch for demands up to 8 feet. For 16 ft. demands, it is only 9% more expensive than 4 inch, so that it seems to be a most adaptable size, covering a range in the ratio of .5 to 16. Diagram J brings out this comparison.

Second, we have for 2-inch distributors, on half foot demand, a distance between feeders of from 1 mile to 2 miles. The maximum variation in the cost per square mile per year is from \$7,860 to \$8,070 or less than 3%. The table shows numerous instances where the spacing between feeders can be varied over a considerable range with very little variation in the cost per square mile per year, which means that this system of distribution is very flexible and adaptable to the varying conditions in the city.

The economical pressure drop in 2-inch distributors, with one exception, seems to be between 18 and 20 inches for all demands. The economical pressure drop in 1¼-inch distributors seems to be about 40 inches; the economical pressure drop in 4 inch seems to be much more variable.

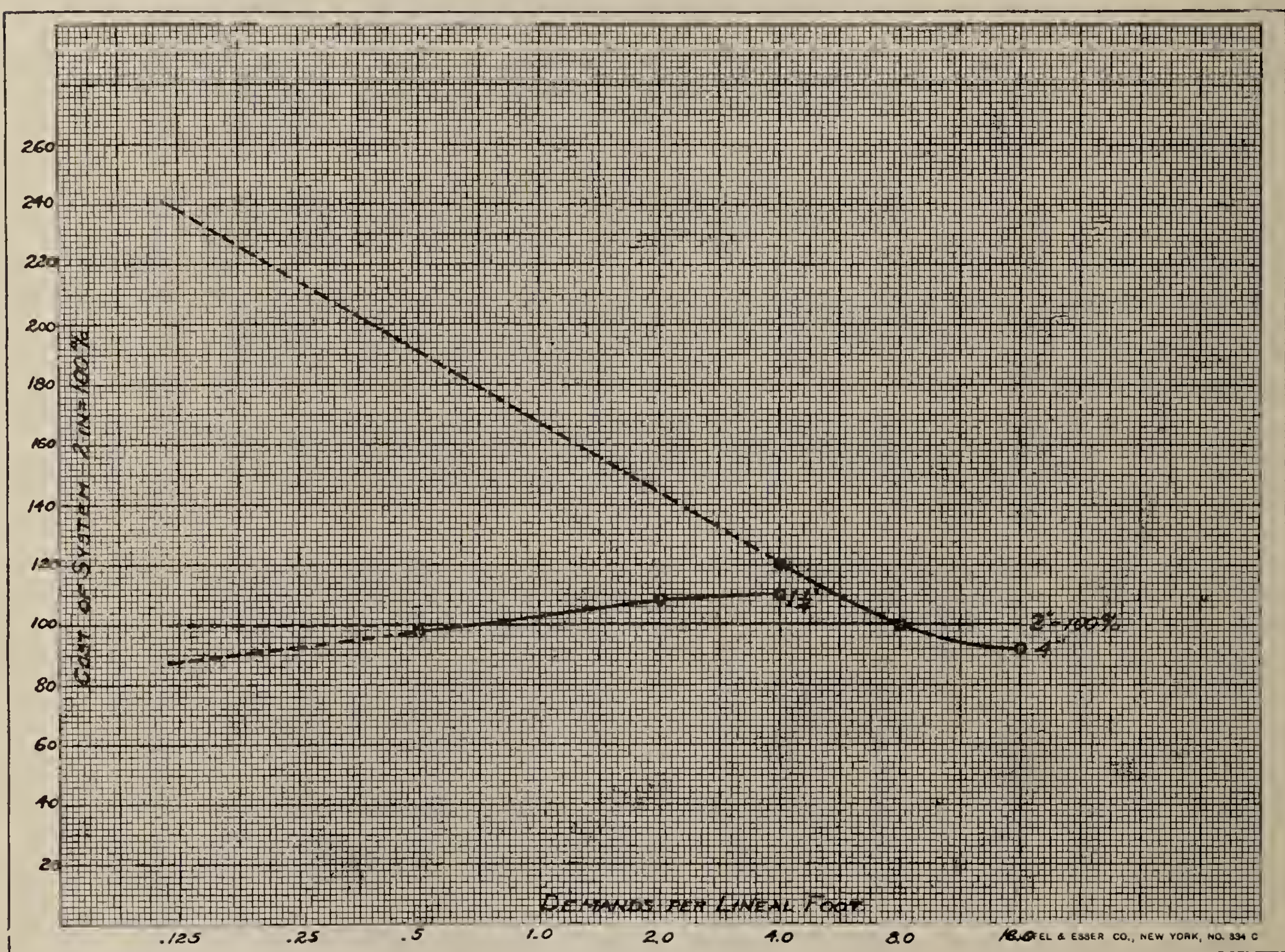


Diagram J

The power cost is not half of the total annual cost but varies between about 18% for 2-inch mains with half foot demands to 40% with 2-inch mains on 16 ft. demands.

The sizes of pipe in the feeder mains vary somewhat with the demand, but, nevertheless show a considerable uni-

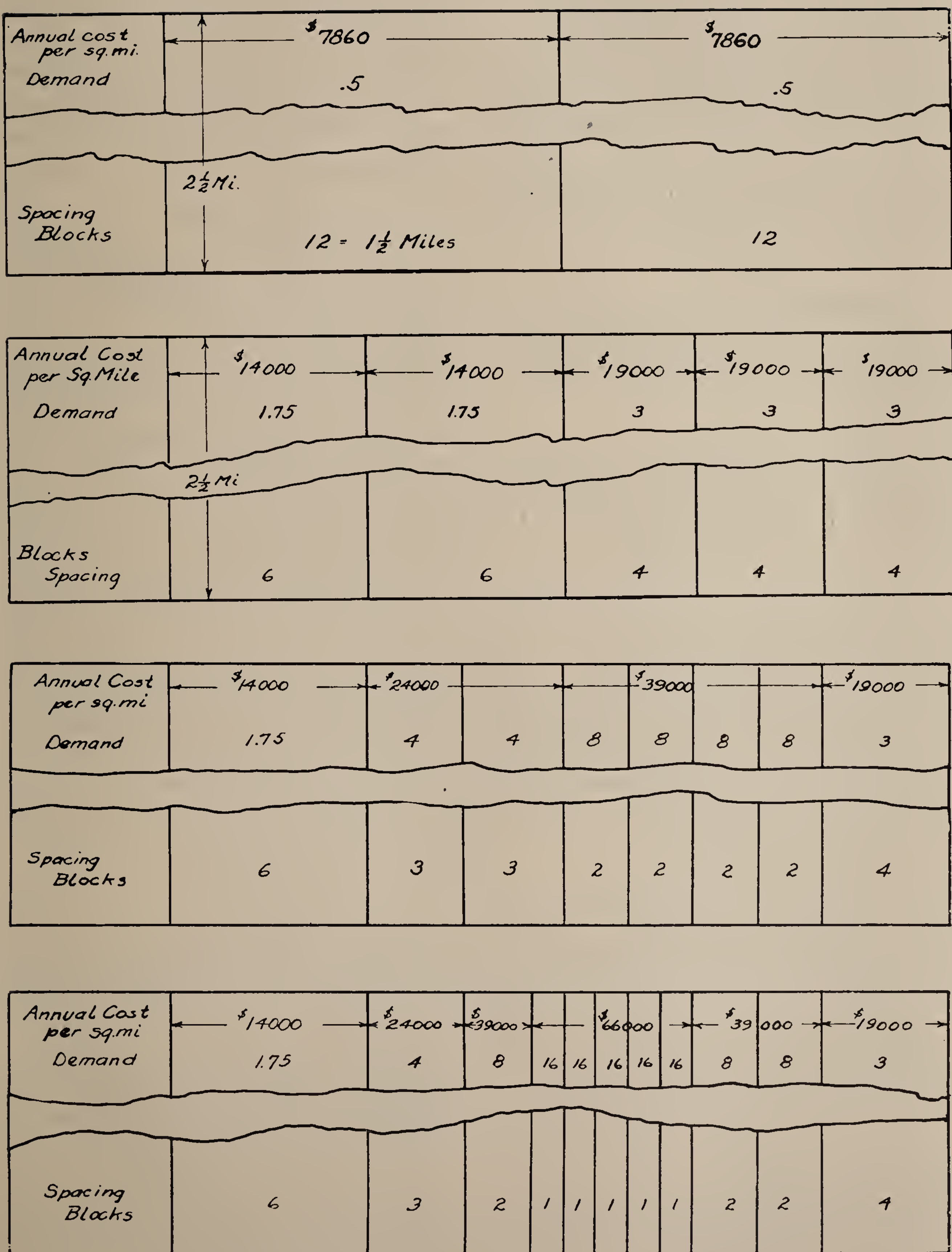

Annual cost per sq. mi.
Demand
$7860
.5
$7860
.5
2½ Mi.
Spacing Blocks
12 = 1½ Miles
12
Annual Cost per Sq. Mile
Demand
$14000
1.75
$14000
1.75
$19000
3
$19000
3
$19000
3
2½ Mi
Blocks Spacing
6
6
4
4
4
Annual Cost per sq. mi
Demand
$14000
1.75
$24000
4
4
$39000
8
8
8
8
$19000
3
Spacing Blocks
6
3
3
2
2
2
2
4
Annual Cost per sq. mi
Demand
$14000
1.75
$24000
4
$39000
8
16
16
$66000
16
16
16
$39000
8
8
$19000
3
Spacing Blocks
6
3
2
1
1
1
1
1
2
2
4

Diagram K

formity. For example, the most economical arrangement for 2 inch with half ft. demands shows feeder sizes from 2 inch to 12 inch. With 2 ft. demands from 3 inch to 16 inch; 4 ft. demands 3 inch to 16 inch; 8 ft. demands 4 inch to 20, and 16 ft. demands 4 inch to 20. This is significant because it shows that the feeder installed, when the demand is small, will be adequate for a very large growth in demand.

The values on this table G cannot be compared with the values shown on Diagram 2 of last year's paper for four reasons.

In the first place, last year's paper shows the original cost per square mile, whereas the present table shows the annual costs per square mile.

In the second place, last year's paper compared distribution systems with exactly the same initial pressure, and therefore the power to pump the gas was in all cases the same, whereas, in the present case, since each size of pipe was utilized at its most efficient point, the power is sometimes quite different and had to be included.

In the third place, last year's paper did not include any transmission mains and, as a matter of fact, made the feeder mains less than a mile long, whereas, in our present design, the feeder mains are 2½ miles long, and there are 5 miles of transmission main included also.

In the fourth place, the blocks are not the same length.

This comparison can be brought out more fully as follows:

The previous paper in table 3 (repeated here as table C) for example, shows that for every mile of distributing mains about $145 per year was expended in fixed charges on feeder mains. In the present discussion, the nearest approach we have to the same demand is .5 of a cu. ft. per lineal foot in which case for every mile of distributing main we have an annual fixed charge of $70 for feeder main; $56 for transmission main; and $90 for power.

To show how a system built to handle a modest demand can be economically increased to handle larger and larger demands, diagram K is presented. This shows at the top of the diagram three feeders of a system able to handle a demand of .5 of a cubic foot per hour per foot of distributor. These feeders are 12 blocks or 1½ miles apart, and the annual cost of such a system per square mile is $7,860. If the demand increases, making some part of this system inadequate, intermediate feeders can be put in as shown in the second case on the diagram, raising the demand capacity as shown on the diagram. The original feeders would still be suitable and no replacement would be necessary. This can be continued until the capacity of any portion or all of the system has been raised to 16 ft. and yet no main has been made obsolete.

In an actual town, due to interference by streams, parks, railroads, or the layout of streets, such a simple and uniform arrangement of feeders may be impossible. A number of alternative layouts of feeder and transmission mains are shown in figures L, M and N, with the total annual cost in each case.

It is evident from these diagrams that there are many ways of feeding the distribution mains with comparatively little difference in annual cost. This makes such a system very adaptable to local conditions.

If we divide the annual cost per square mile by the aggregate demand on that square mile, we get a cost per foot of demand which varies from 20c per cubic foot per hour, when the demand is small, to 5c per cubic foot per hour when the demand is large.

approximately the ratio called for by the Rate Structure Committee's reports.

The $6,000 would be pro-rated equally among the customers in a square mile, which would make this single item contribute to the Customer Charge

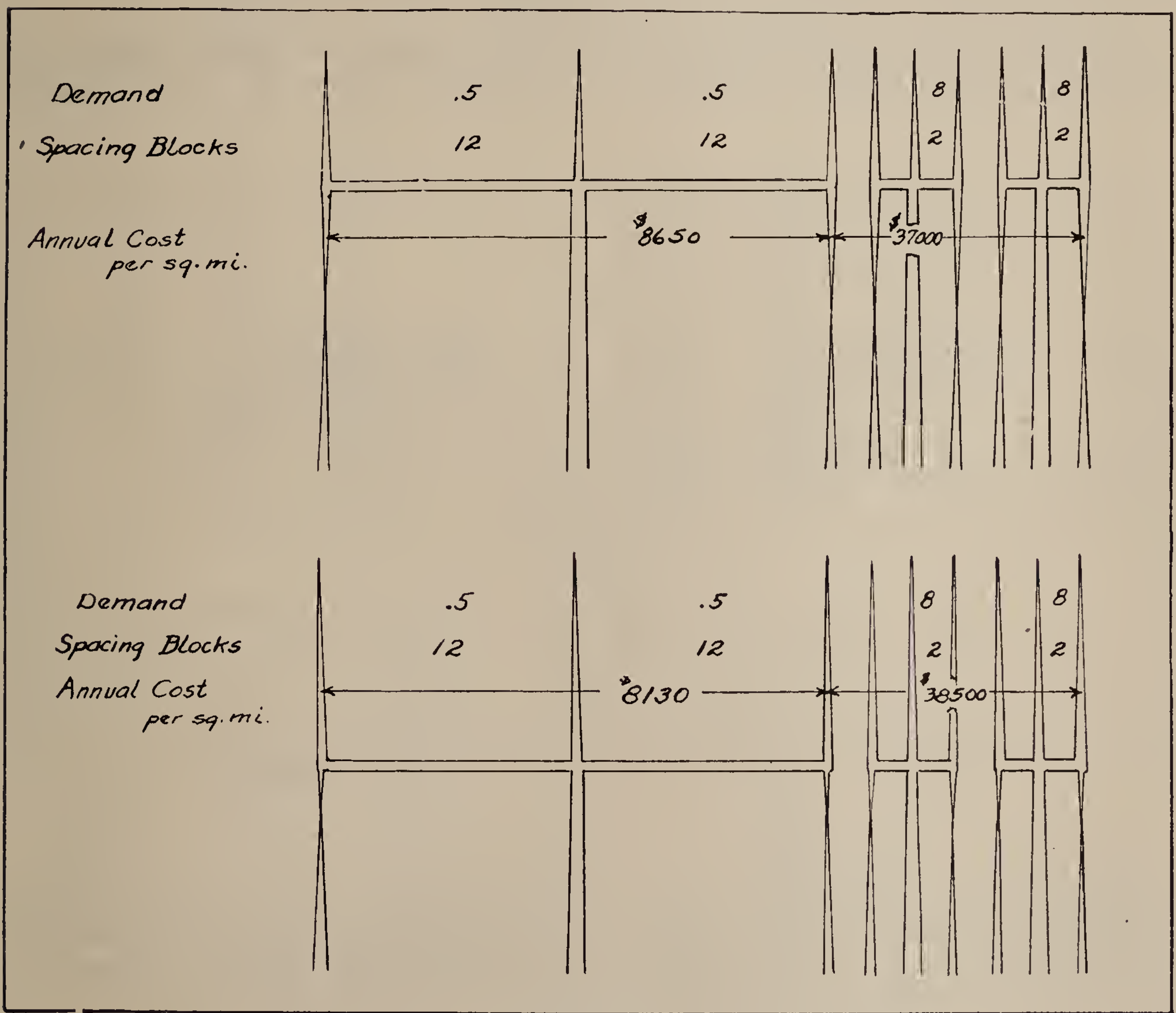


Figure L

If, however, we deduct about $6,000 in each case, and divide the remainder by the demand, we get a very uniform figure as follows:—

Demand	—	.5	2	4	8	16
Cost per ft.	Cts.	4.75	5.9	5.3	5.0	4.3

This is the real justification for dividing the fixed charges on a Distribution System between customers and demand in about $4.00 a year when there are 100 customers per mile.

The attention of the Committee has been called to the following argument, as tending to disprove the advantage of small distribution mains.

It is found that the investment in mains in Chicago, for example, is about

$1.10 per thousand cu. ft. sold per year, whereas in Denver, where 2″ mains have been used very largely, the investment per thousand cu. ft. sold per year is about $1.40. These two figures, however, do not tell the story because Chicago sells 10 million cu. ft. per mile of main per annum, whereas Denver sells about 5,200,000.

Certainly, no one will argue that Denver, by adopting Chicago's main sizes, could directly or indirectly increase their sales per mile of main from 5 million to 10 million cu. ft., nor could he argue that, if Chicago had adopted Denver's main sizes, that their sales would be automatically limited to 5 million cu. ft. per mile instead of 10.

If Denver had adopted Chicago's main sizes then Denver's investment, per thousand cu. ft. sold, would be about $2.75 instead of $1.40, whereas, if Chicago had adopted Denver's main sizes their investment, per thousand cu. ft. sold, would be about 55c instead of $1.10.

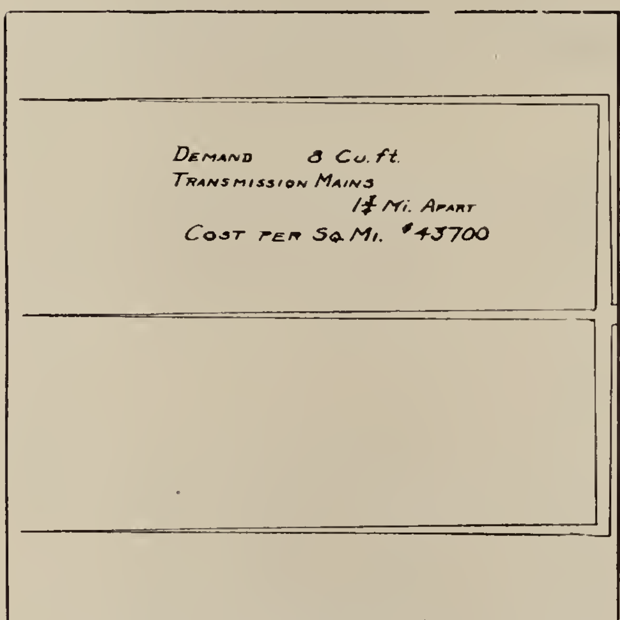


Figure M

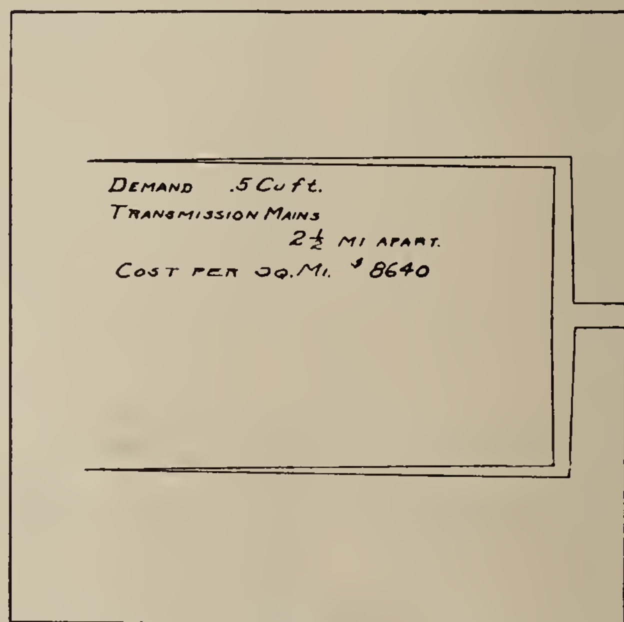


Figure N

Where mains must be laid or repaired under paving, the expense for cutting through such paving and the expense of restoring pavement represents a larger tax on the gas business than is usually appreciated. The following is a quotation from a valuation engineer which sheds some light on the magnitude of this burden.

"On the basis of fixed charges being computed at 10% of the investment cost and assuming the present sales of gas, paving over mains is responsible for the following cost per thousand cubic feet in the various towns:

Bristol	$ .119
Sedalia	.191
Danbury	.09
Hattiesburg	.038
Knoxville	.119
Lebanon	.118
Lincoln	.113
Meridian	.132
Montgomery	.145
Salina	.092
Spokane	.159
Denver	.021"

LAYING MAINS IN PARKWAY

	Amount Distribution System in Parkways	*Ordinance*	*Physical Conditions*
Bartlesville Gas & Elec. Co. Bartlesville, Okla.	Small nothing definite stated	None. New paved streets not to be opened for a number of years	In downtown district paving extends to the curb
Republic Light Ht. & Pr. Co. Tonawanda, N. Y.	Small nothing definite stated	None. Have had no trouble getting permission from city	Limited due to shade trees in parkway
Ohio Public Service Company Mansfield, Ohio.	Small just main of recent years	None	Downtown district impossible
Salina Light, Power & Gas Co. Salina, Kans.	None	Requiring mains be laid in streets to be paved	
Ohio Public Service Company Alliance, Ohio	Valuation report shows 34% of 242,830 ft. of main under pavement. 50% of remainder in parkway	No restrictions	So far no physical difficulties
Pueblo Gas & Fuel Company Pueblo, Colo.	Nothing stated	No restrictions	Trees in parkways, sewer manholes at street intersections, property owners object
Western Light & Power Co. Boulder, Colo.	Nothing stated	No restrictions	In downtown section walks extend to curb, space under sidewalk used by owner for coal, etc. In residence sections trees in parkways. Mains be disturbed by roots of trees. Gas leak would kill trees.
Spokane Gas & Fuel Company Spokane, Wash.	A few	Requiring all mains to be laid in streets or alleys	
Denver Gas & Electric Light Co. Denver, Colo.	A total of 2669 ft. of their entire distributing system	None. Would have to obtain a special permit from the Park Department to lay mains in parkway	Property owner objection, civic pride. Tree line established in centre of parkway. Roots of trees disturb mains, sags traps and breaks
Knoxville Gas Company Knoxville, Tenn.	Nothing stated	None. New paved streets not to be cut for three years, according to new ordinance being prepared	Where distance between sidewalk and curbing is narrow inconvenient to lay mains
Montgomery Light & Power Co. Montgomery, Ala.	None stated	None	Width of grass plot very narrow. This and tree conditions prevent laying mains in parking
Fremont Gas, Elec. Lt. & Pr. Co. Fremont, Neb.	Two streets	None	Large number of trees
Lebanon Gas & Fuel Company Lebanon, Pa.	Nothing stated	State law against laying mains under sidewalks	

Table P

	Laying New Mains	Old Mains	Under Sidewalks	Comments
Bartlesville Gas & Elec. Cc. Bartlesville, Okla.	All new mains that are possible are laid in parkways	Where city is paving, all mains possible are put in parkways	They believe they can get permission. Would require tearing up both sides of street	Consider it cheaper to put mains in parkways as streets are very wide
Republic Light Ht. & Pr. Co. Tonawanda, N. Y.				
Ohio Public Service Company Mansfield, Ohio.	All mains of recent years put in parkways	In favor of putting old main in parkways when paving is to be done	Some mains have been laid in grass plot inside of sidewalk	Cost of making repairs and finding leaks considered much less. Gas explosions greatly reduced
Salina Light, Power & Gas Co. Salina, Kans.	Think they could get permission to lay in parkways	Have repaired them ahead of paving and put in stubs to the curb		
Ohio Public Service Company Alliance, Ohio	All main extension on paved street put in parkways	On streets where paving is to be extended beyond mains, the mains are stubbed to parkway on each side		
Pueblo Gas & Fuel Company Pueblo, Colo.	Think it possible to lay more mains in the future in parkways	Old mains are stubbed to parkway when paving is extended		
Western Light & Power Co. Boulder, Colo.				
Spokane Gas & Fuel Company	Laying mains ahead of paving and stubs to curb			A few mains in parkway there due to street being narrowed
Denver Gas & Electric Co. Denver, Colo.				
Knoxville Gas Company Knoxville, Tenn.	On many of streets mains are now being laid in parkway		Not mentioned	In running stubs ahead of new paving stubs large enough to handle several lots are used
Montgomery Light & Power Co. Montgomery, Ala.	Believed to be good idea where physical conditions permit		Not mentioned	
Fremont Gas, Elec. Lt. & Pr. Co. Fremont, Neb.	Thinks might be done provided property owners were agreeable			
Lebanon Gas & Fuel Company Lebanon, Pa.				

Table P

To avoid this pavement expense, both in the original installation, as well as in the maintenance of the main, some companies have for many years been laying their gas mains between the curb and the sidewalk. By so doing, the services on one side of the street are, of course, much longer but approximately the same number of services on the other side are shortened by the same amount, so that the total cost of services, as well as the total cost occassioned by paving over services, would be the same.

Table P shows a digest of the answers to a questionnaire sent out to a number of gas companies on this problem. There are several places, other than under the street paving, that would seem to be preferable for the location of gas mains. If the space between the curb and the sidewalk is free, this would make a particularly good location. Some companies, you will note, have been able to lay mains between the sidewalk and the property lines. As a last resort, however, the laying of mains under a sidewalk would occasion very much less expense than laying the main under the paving between the curbs. Most sidewalks, nowadays, are either flag stones or concrete, either one of which can be taken up with very little breakage and replaced in as good condition as it was formerly. Certainly, a sidewalk can be taken up and replaced with less damage to its future usefulness and maintenance, than a cut in a modern pavement, consisting partly of reinforced concrete.

One legislature has had before it a bill giving municipalities the power to require gas companies to lay two mains so that no services would have to be laid under the pavement. The Gas Association should watch any such legislation to be sure that it does not require expenditures out of proportion to the benefits derived.

Conclusion

In conclusion, our investigation shows first, that cheaper distribution mains will give equivalent service without individual regulators. In particular, that on all but a small fraction of any distribution system, 2″ distributing mains can be used without regulators to give the same service that larger mains would give, and at a fraction of the investment costs.

Second—That the maintenance on distribution systems using steel pipe is very small. The data shows that the total renewal cost is only a small fraction of the difference in interest charges between 2″ steel and the usual cast iron mains.

Third—That the capacity of distribution systems, using cheap distribution mains, can be readily increased without making any part of the system obsolete. In particular, using two-inch steel pipe for distributing mains, the capacity can be carried to four cubic feet per hour per lineal foot of main, at less total cost than with larger mains, and by utilizing efficient pressure, this capacity limit can be increased to eight cubic feet per hour per lineal foot of main.

Fourth—That with the increasing cost of pavements, the location of mains at some other place than under pavements must be given careful consideration by gas companies, both for economy and to protect themselves from unwise legislation.

R. G. Griswold (New York, N. Y.): One of the things mentioned in this report that should certainly be continued by the Association is the problem of laying mains in some less expensive place than under the heaviest and most expensive pavement between property lines. One reason why that is important is that some of the state legislatures are considering the enactment of laws which might require us to lay two gas mains on each street. Now to lay two gas mains is going to be more expensive, considerably more expensive, than laying one, in spite of the fact that you save on the services when you lay two mains. Unless the services are unusually close together and the pavement is unusually wide and unusually expensive, it is going to be cheaper to lay one main on one side out from under the pavement and run the services from the other side of the street clear across under the pavement.

If the Association does not take active steps on this point the legislatures may require us to lay two mains, and that would be unfortunate for us as well as for the customer.

Walton Forstall (Philadelphia, Pa.): I think we are indebted to Mr. Griswold for this report. I have not studied it as much as I would like. Some things I do not agree with at all, but undoubtedly we want to avoid getting into a rut, and for those of us who think that 6 and 4 inch cast iron mains are pretty good things to tie to, it is a very good thing for us to have a two-inch steel pipe thrust into our face, even though we may not take it in very large doses.

One of the appendices, I think, showed in territory on the outskirts of Philadelphia, that the output, between about four and six o'clock, ran along at an even 15-minute rate. That is not true of Philadelphia, and a lot of those people certainly do work in Philadelphia. I am wondering whether some mistake was not made. We find that the people who are cooking, do so as a rule between five and six and in the old days when we could bring that down to a 5-minute rate we found quite a difference between that 5-minute rate as darkness came on. So I think that table of 100 cubic feet in this particular territory for every 15 minutes between four and six is important if true.

W. J. Beckjord (New York, N. Y.): Our distribution men find that from a theoretical standpoint undoubtedly in most cases the two-inch pipe would take care of the situation adequately, but theoretical considerations are not necessarily the limiting factors in the design of distribution systems.

We find that there is a great accumulation of rust in the pipe, from cyanogen and drippage and probably some tar, that in a short time would completely fill up a two-inch pipe, whereas in a four-inch pipe you have more leeway. In our northern properties we often find cases where the frost would completely fill up a pipe, and of course in the case of the two-inch pipe your reserve in that would be very much less.

Also in cleaning out our steel services and blowing them back into the mains there is always a pile of dirt collects at the pipe connection, and in many cases even in a four-inch main, that will completely shut off the service. We have been experimenting with the vacuum system in blowing out the dirt, but that is a pretty expensive proposition and as

yet has not been perfected to the point where we can use it.

Replacing mains in our modern cities, especially with the heavy concrete base pavements, presents another difficulty. If you have to replace a main every ten years, say, you would be open to the necessity of tearing up the streets almost constantly. The suggestion to lay mains behind the curb, as is done in many cities, would obviate that, but in some cases there would not be room enough.

In some of our properties, due to soil corrosion, the steel service pipes have to be wrapped in burlap and pitch in order to keep them in service any time at all. Of course, if we attempted to wrap steel mains, it would materially add to the cost.

Again, if we go to materially lower B.t.u. gas, this may call for increased distribution capacity. In the new outlying districts where, due to the geographic layout of the city, we cannot have sufficient cross tie mains, it would be difficult to secure sufficient capacity with two-inch mains.

We are endeavoring to give at least two and one-half to three inches pressure at the stove, and if our distribution system is not amply adequate to take care of the five-minute demand, it would be pretty hard to give regulation within two and one-half up to six inches.

Electrolysis is prevalent in most of the larger properties. We have been very successful with cast iron mains with cement joints in the way of electrolysis prevention. That is a very material consideration in connection with the maintenance on the mains and the continuity of service.

Sections of cities may entirely change in character of the buildings in a very short space of time. A strictly residential section in less than five years' time may change to a business district which would, of course, very materially increase the demands.

Actual tests on many Detroit districts show that while the five-minute demand per consumer on districts where there are small homes would run probably 18 to 20 feet per consumer, (about a foot and a half to a foot and eight-tenths per foot of main), in other districts with larger homes it will run up as high as 42 feet per consumer. Many of those are very long streets with very few cross streets so that it would be a very difficult matter to get in cross mains. In such cases, pressure difficulties would be almost certain.

M. I. Mix (Chicago, Ill.): I think that some of the fundamentals there are sound, and a study of each district should be made to determine the most economical type of design.

There is one point that I want to bring out in connection with the statement: "If Denver had adopted Chicago's main sizes then Denver's investment, per thousand cu. ft. sold, would be about \$2.75 instead of \$1.40, whereas if Chicago had adopted Denver's main sizes their investment, per thousand cu. ft. sold, would be about 55 cents instead of \$1.10." While Mr. Griswold's theory is fundamentally correct, it would be just as impossible for Chicago to adopt a two-inch system as it would for Denver to adopt a one-inch system, due to different conditions. The report also brings out what to the ultimate consumer would probably mean the most, namely, that Chicago is distributing gas to consumers at a dollar and ten cents per thousand cubic feet sold per year of investment, whereas Denver is distributing it for a dollar and forty cents.

This is bringing it cheaper to the consumer of Chicago. But whether the consumer of Chicago is really getting it as cheap per thousand investment as it could be is another question.

It seems to me that they are comparing cast iron fittings against wrought iron service. Cast iron fittings are a good deal more brittle; there is no question about the durability.

Chicago tests last summer showed that about 90 per cent of the leakages were in services which are wrought iron. Electrolysis conditions are no doubt one of the principal factors in whether cast iron or wrought iron should be selected. For certain territories corrosion may be prevented, but with Chicago's electrolysis conditions I believe we are getting a good deal better wear out of the cast iron.

R. G. Griswold (New York, N. Y.): Mr. Beckjord said that with two-inch mains he anticipated stoppages which he would not have if he had a larger main, and I grant that that may be true. Even so, it is cheaper to use the small main because you save so much investment thereby that you can well afford to correct these local stoppages as they occur. As I said in my opening remarks, it is extravagant to try and build a system on which you will not have any maintenance.

Frost in the main presents a question where you have to push a pencil to see whether you can better afford to lay the main a little deeper or use a larger pipe. I think you will find it cheaper to lay the main a little deeper.

One member of the committee just showed me some figures on steel mains laid in 1900 where the total replacements on account of electrolysis to date are less than two per cent. That is not two per cent a year but two per cent in 23 years.

We tried to answer the corrosion question when we collected the data shown in this report. We tried to get actual figures so definite as to when the main was laid and what the repairs amounted to, that there could not be any question about it. That data indicates that the tax that you incur by using steel pipe, on account of its supposedly less durability, is apparently less than one per cent.

In one of the cases cited in this report we called attention to the fact that the total money spent in street maintenance was only about one per cent on the two-inch pipe in that distribution system. It should have been added there that the two-inch pipe only represented about half of the total distribution system and the other half certainly had some maintenance on it.

AN EXPERIMENT IN RESIDENCE GAS HEATING AT DENVER, COLORADO

T. M. Foulk, Engineer of Utilization and T. G. Storey, Superintendent, House Heating Division, Denver Gas & Electric Light Co., Denver, Col.

During the winter of 1922-23 The Denver Gas and Electric Light Company inaugurated an experimental program of residence heating with gas. It is the purpose here to report; first, the conditions under which this program is being conducted; second, the methods and experience relative to installations, and third, the economic results obtained.

It may be interesting to consider first some of the general heating situations existing in Denver. In the first place, the city is located in the heart of Colorado's lignite beds, which makes available an abundant supply of comparatively cheap fuel. It also has extraordinary temperature conditions. A survey of average monthly temperatures prevailing in Baltimore, Chicago, Portland, Los Angeles, St. Louis, San Francisco and Denver for the past fifty years shows (Figure 1) that Denver has the lowest average temperature during the heating season, with the exception of Chicago. In addition to this, it is subjected to wide variations and sudden changes in temperature during the winter months. Consequently, a fuel that readily lends itself to meet such conditions has decided advantages.

Another point of interest, bearing on the general heating situation, is the fact that a gas, low in heating value, is being successfully utilized; this value being 400 B.t.u., 30″ Hg and 60° F.

The most important preliminary step was the selection of a suitable rate. After a study of the situation, the following three-part rate was adopted:

Rate "U"

House Heating Service—Temporary Three Part Rate

Available to any customer for house heating and other domestic fuel purposes.

Rate (Three Parts)

(1) A Customer Charge:
Per customer per annum $9.00
(Payable in 12 equal installments)

(2) A Demand Charge:
Per 100 cu. ft. of maximum hourly demand per annum 21.00
(Payable in 12 equal installments)

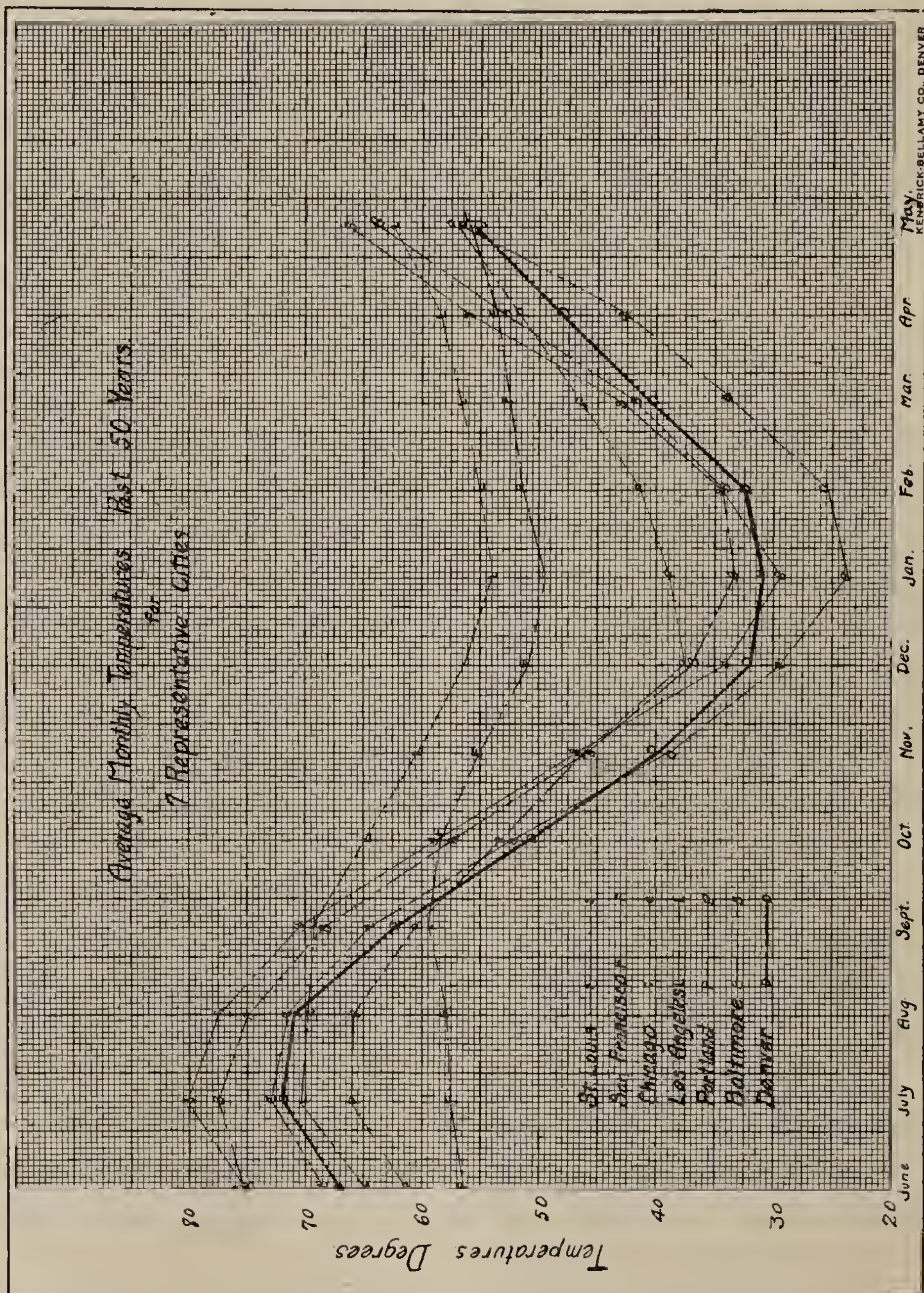


Fig. 1

(3) A Consumption Charge:
Per 1,000 cu. ft. of gas metered .... .40

Discount:

For payment of any bill within ten (10) days after it is dated 10%

Under the rate, the customer's maximum hourly demand is determined by actual test after the installation has been completed.

Another important preliminary step was the selection of a basis for estimating the heating costs to the customer. To assist in this, the following formulas are used, which give approximate gas consumptions:

1. Hot Air—Cubical contents of the building in feet, multiplied by three, gives the average gas consumption in

cubic feet per month for the eight months.

2. Hot Water—The number of square feet of radiation, multiplied by 120, gives the average gas consumption per month for eight months.

3. Steam—The number of square feet of radiation, multiplied by 240, gives the average gas consumption per month for eight months.

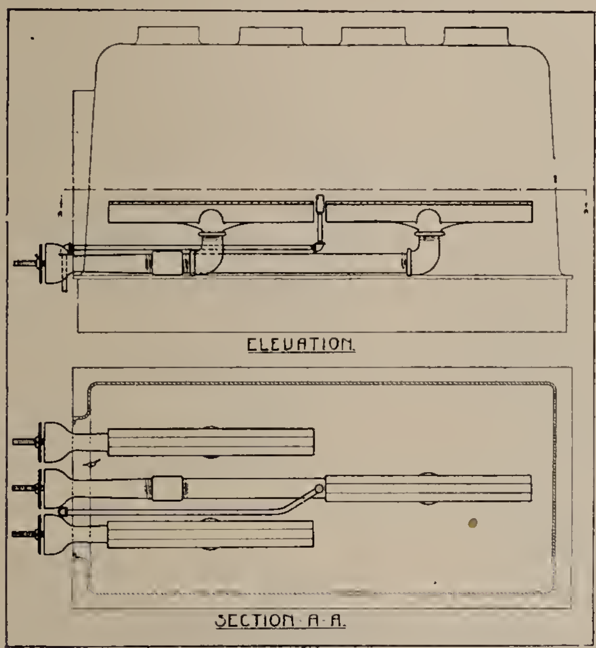


Fig. 2

The demand to be established for an installation is governed by the size of boiler, number of burners used, and the requirements of the customer.

Gas-fired boilers are selected to take care of the necessary amount of radiation. A demand of seventy cubic feet per boiler section is used to determine the maximum hourly demand, as the burners are adjusted by the manufacturer.

The size of hot air furnaces depends upon the cubical contents of the building, which in turn controls the number and size of burners to be used, and consequently the demand. These demands range from 250 to 500 cubic feet per hour.

In the case of the conversion of coal-fired boilers to burn gas, the demand is dependent upon the number and size of burners required for that particular size of boiler.

Methods of Installation

The installations in Denver may be divided into three main classes: gas-fired hot air furnaces, coal-fired boilers converted to burn gas, and gas-designed boilers.

1. Hot Air Furnaces

Several types of gas-fired hot air furnaces were installed. The standards of construction are not up to those of the gas-fired boilers since these furnaces were all constructed of sheet metal. Some doubts were entertained about the lasting qualities of an all sheet metal furnace. Special mention might be made of one type which was made of large drums and could not be taken through the ordinary door, so it was necessary in some cases to cut a passage through the foundation.

As all the manifolds and mixers were designed for natural gas, they had to be replaced by equipment designed for manufactured gases, which is shown in Figure 2.

Hot air furnaces were sold in three sizes, for $100.00, $121.50 and $140.00, respectively. The average cost of installing the furnaces was around $100.00. Some of the older places ran higher, for in all cases an inside cold air duct was required, and any additional piping deemed necessary to insure satisfaction. A thorough check was made in all cases before signing the customer. and all changes agreed upon.

2. *Conversions*

A standardization of burners and baffling used in the conversion of coal-fired boilers to burn gas was hampered somewhat by the difference in design of the boilers undertaken. The systems shown in the sketch of a round conversion (Figure 3) and illustrations of a sectional boiler conversion (Figures

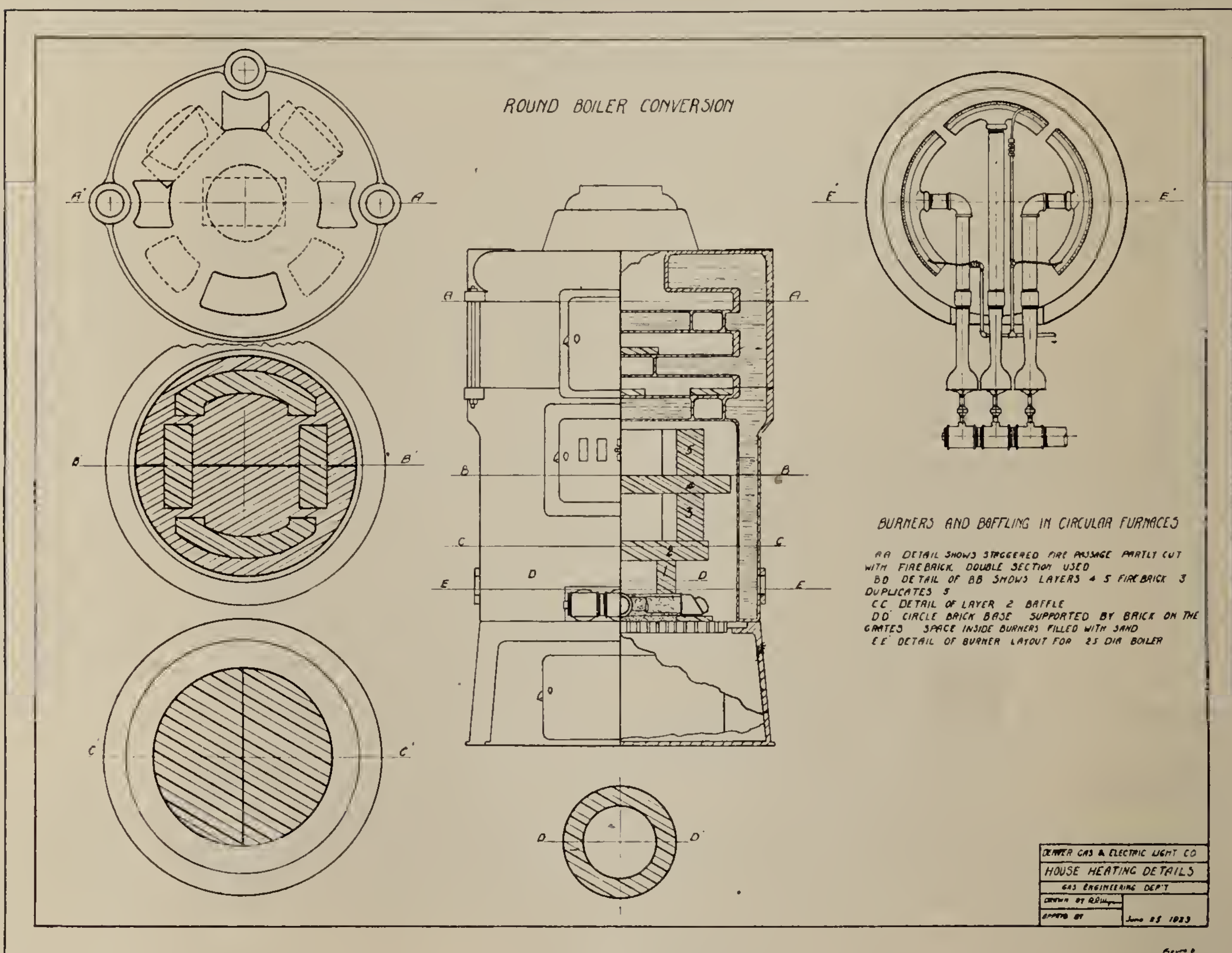


Fig. 3

4, 5, 6 and 7) were followed as closely as possible.

Since experiment and theory indicated that the best results were to be obtained when the flames impinged upon the water leg, burners that would fulfill this condition were desired. Straight cast iron tee burners in three sizes and circular cast iron burners in two sizes were used. Throat mixers were designed, as shown in Figure 8, with threaded ends, so that the burners and mixers might be connected with 1½ inch pipe, and threaded joints, with mixing and burner tubes butted together, thus preventing eddies, and creating a substantial joint, which held the burners firmly in position.

After selecting the burners and mixers, the problem of their placing in the boiler was considered. The most convenient and desirable method was to insert the mixers through the clinker door. If the clinker door was too small, the mixers were put through the ash door and part of the grates removed. When the grates were removed, a support for the burners and baffling was made of strap iron.

Baffling from a standpoint of efficiency of operation is the most important part of the conversion. Good baffling requires a great amount of care and experience on the part of the workman, with close adherence to that arrangement which has been found to give the best results. A variety of methods have been tried, and the one shown in Figure 3 was adopted for round boilers.

A circle brick (Section D′D′) 4 inches to 6 inches high, and with a diameter 3 inches to 4 inches less than the burner ring, forms the base piece, as shown in layer No. 1. Two flat tile, forming a circle 6 inches smaller in diameter than the fire pot form layer No. 2, section C′C′. Layers Nos. 3 and 5 are formed from two arches 3 inches thick and 5 inches high, section B′B′, while No. 4 is made of flat tile, with a diameter 2 inches smaller than the water leg. Layers 3 and 4 are repeated

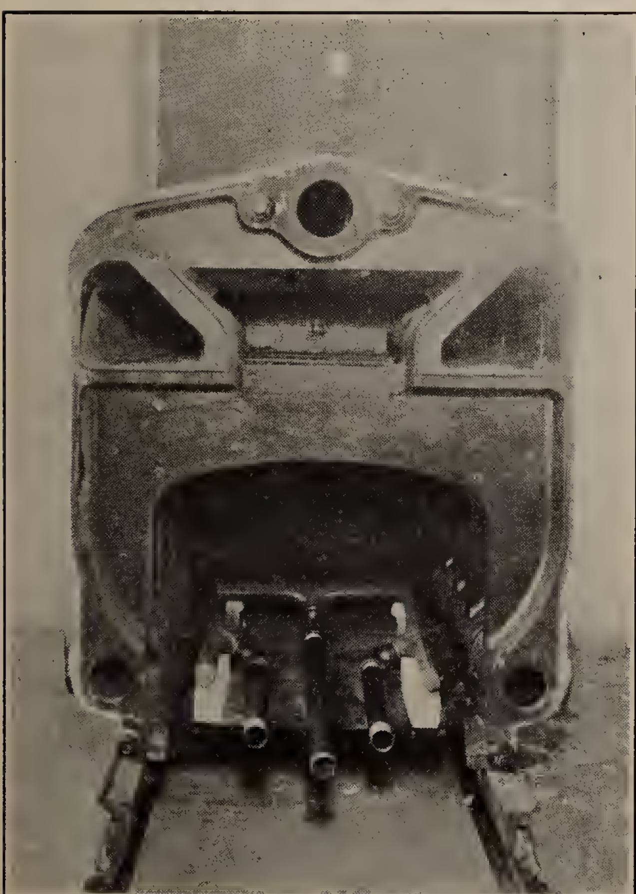


Figure 4.

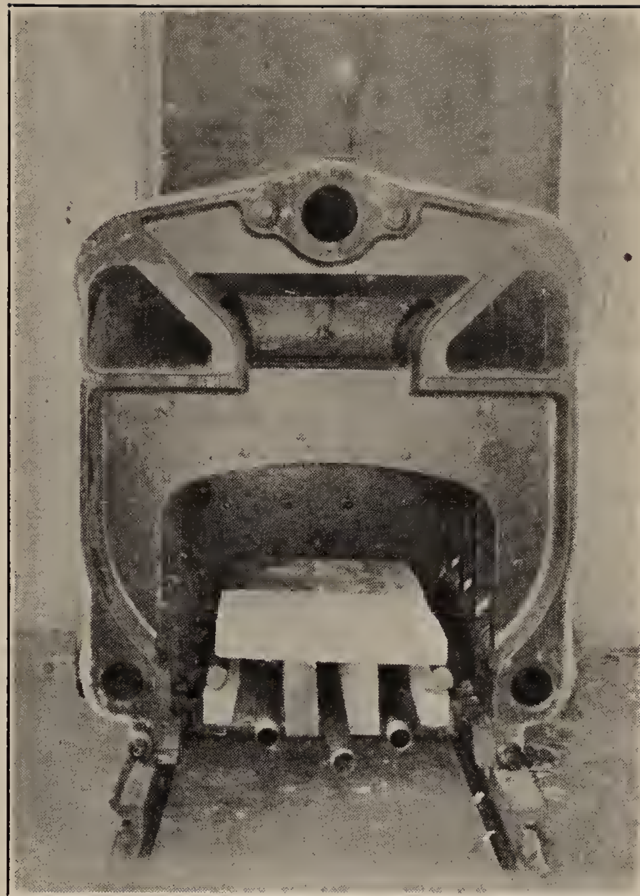


Figure 5.

alternately until the top of the section is reached. Firebrick splits are used to partially close the gas passages in the boiler above the firepot, thus increasing the length of fire travel, rate of flow and diffusion of gases.

The baffling for sectional boilers follows the outline for round boilers, as is shown in Figures 4, 5, 6 and 7. The lower layer is kept three inches and succeeding layers one inch from the water leg.

The pilot lights for conversions are made of three-eighths inch copper tubing, split down two inches and flattened so that a flat flame results. This tube is curled over the end of the burner to insure ignition. Pilots are so placed that they may be easily lighted and seen. They burn on the average about seven cubic feet per hour.

The door through which the mixers

enter is removed and the opening is partially bricked up. Sufficient openings are left for secondary air and the job is finished neatly with a good grade of cement.

The piping, valves and manifold are standardized to two-inch fittings. The manifold is made up of a 2″ x 2″ x ¾″ tees and close nipples.

The water coils were always removed before converting a boiler. It was found that their presence interfered so greatly with the setting of a baffle that poor efficiencies resulted. In one or two cases coils have been used to good advantage in the flue, reducing the stack temperature; however, in all cases standard gas water heaters have more efficiently provided for hot water requirements.

The equipment for the average conversion amounts to about $65.00. In most cases, two experienced men can complete the job in one day, though when the grates have to be removed, a longer time is required.

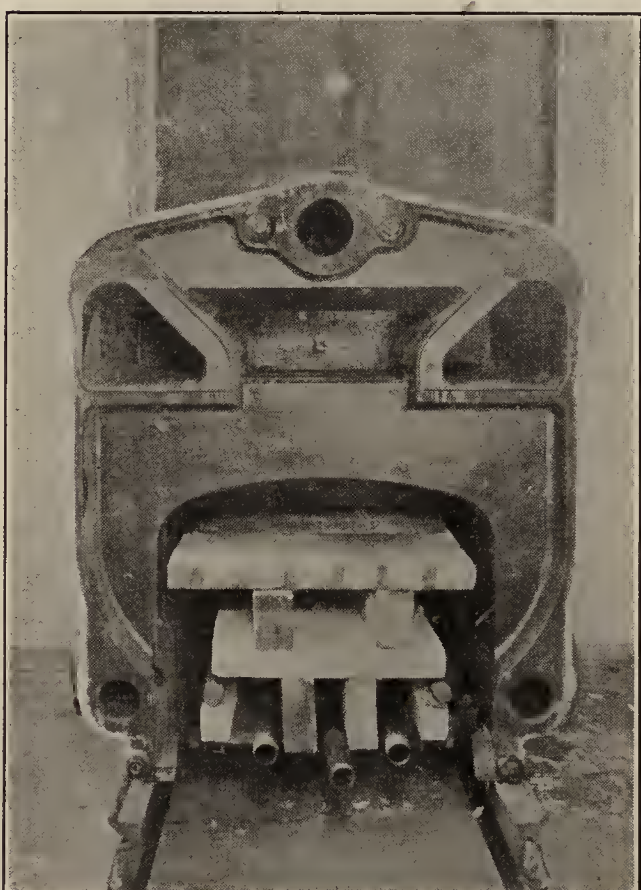


Figure 6.

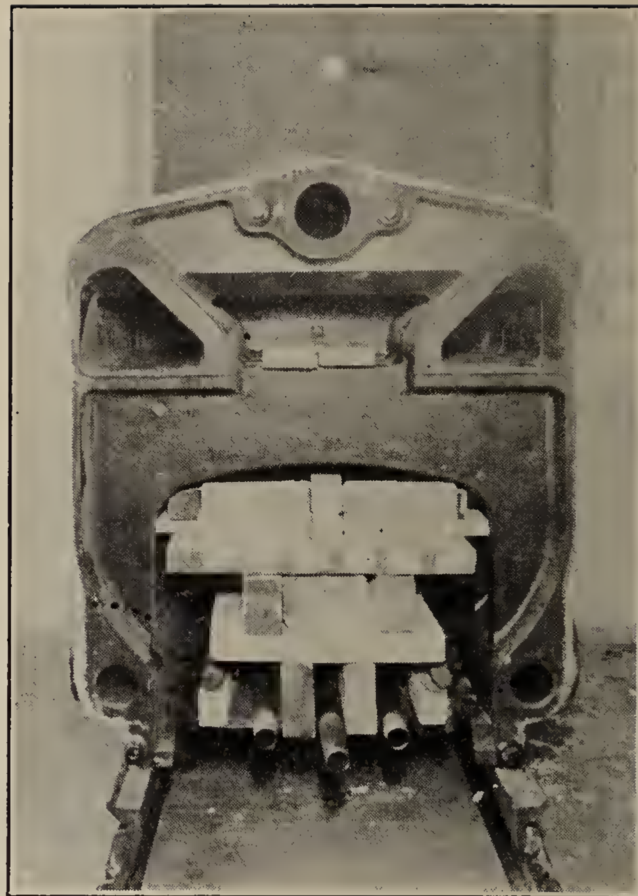


Figure 7.

3. Gas-Fired Boilers

The first cost of a gas-fired boiler is little more than the cost of an equivalent coal-fired boiler. The cost of installing a gas-fired boiler is very low, since the boiler stands on the floor, takes very little room and requires no pit.

After a gas-heating system was installed and operating, a flue gas analysis, including a determination of CO_2, O_2 and CO, and stack temperatures, was taken. From the analysis the need of adjustments could be readily seen and changes were made until a good analysis was obtained.

Increased efficiencies in operation

were obtained principally by reducing stack losses. The burners used were cast on good principles, both from design and operation standpoints. Radiation losses were reduced to a minimum by the proper use of good insulating materials in jacketing the boiler and piping. The stack losses were the only losses that could not be easily controlled, being the sum of several factors which must of necessity be considered in the analysis the secondary air openings were enlarged and dampers adjusted. Generally, the air was in excess and openings and dampers had to be closed.

The proper adjustment of secondary air is very important. All air in excess of that required for proper combustion, which enters the furnace, is heated up when passing through the combustion

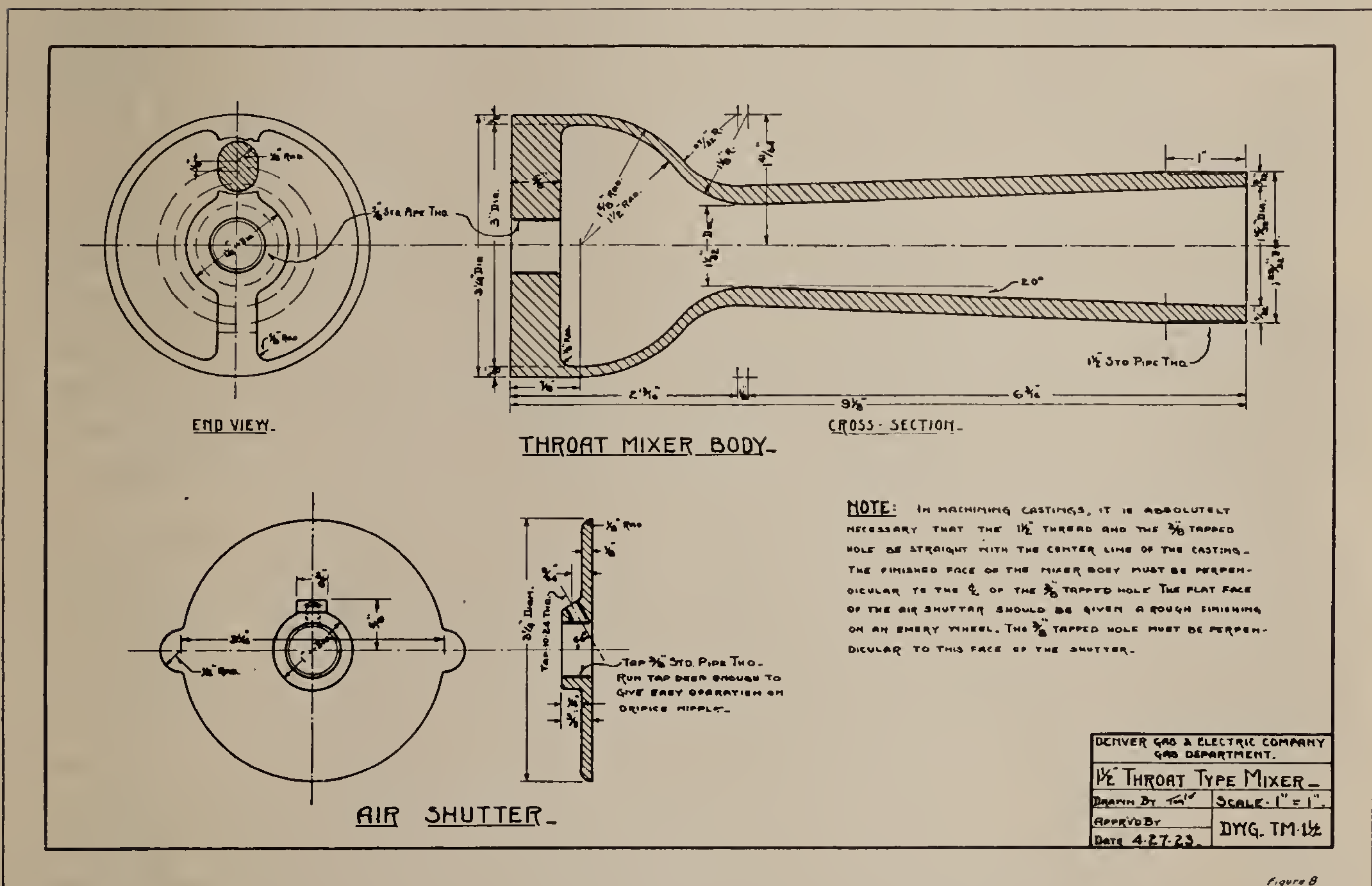


Figure 8.

and adjusted simultaneously, such as gas pressure and rate, secondary air adjustment, baffling, drafts, check valves and dampers.

The adjustments on gas-designed equipment were easily and quickly made, while those on conversions often required considerable time. Since no two boilers operated under the same conditions of flue connections, cut and try methods were used. If CO appeared chamber and up the stack, absorbing heat which is lost in the open air. While it is neither desirable nor practical from the standpoint of satisfactory operation to decrease the secondary air to the theoretically proper amount, the over-ventilation in most cases was greatly reduced. Experiments led to the conclusion that approximately 25-40 per cent over-ventilation with gas-designed equipment, and 40-55 per cent for conversions would give satisfactory

results under all conditions. In calculating stack losses the moisture content of the flue gases was taken into account. It was found that the average stack losses for the gas designed boilers were 12 per cent and those of the hot air furnaces and conversions were 15 per cent.

Very little trouble occurred during the past season. The automatic water pans on the hot air furnaces gave some trouble from valves and resultant overflows. This was eliminated by manual control of the water valve. Some trouble resulted by pilots carbonizing, but this was very small.

The majority of installations were thermostatically controlled, and such control was strongly urged. The heat regulators were installed at a cost to the customer of from $80.00 to $105.00.

The best condition for both the customer and the company is to have a low demand and long heating period. The thermostats tended to give this, since they were set to turn the gas on early and keep a constant temperature throughout the day.

Economic Results Obtained

A summary of house heating data comprising thirty-six representative installations, of which there were sixteen gas-designed hot air furnaces, sixteen conversions of coal-fired boilers and four gas-designed boilers, is shown on the chart, Page 9. In order to make proper comparisons, the values shown cover heating only. Separate meters were set in the fuel runs to the heating burners and demands and consumptions were separated from the other domestic appliances.

The demands given on the chart were determined by actual test after the installation was adjusted and in use. It will be noted also on this chart that many of the consumptions for the earlier months were calculated to give complete data for the season. This was necessary since there were an insufficient number in operation at that time to give proper comparative data on the various types of installations covering the entire season. These calculated values were based on the average monthly temperatures and cover such a small part of the total consumption that the error introduced is negligible.

The "readiness to serve" charge shown here covers the customer and demand charge for the twelve months. The cost per million B.t.u. of gas used is estimated on the basis of a heating value of 400 B.t.u. per cubic foot standard conditions, 30 inches—60 degrees.

The amounts and cost of the coal given were obtained from the customer, and since it was necessary in the majority of instances to depend upon memory, some error has, no doubt, been introduced in these figures. It was also impossible to ascertain the exact kind of coal used, and hence, the B.t.u. content had to be calculated from the cost and the heating values of Colorado coals listed on the market at those prices. The total cost of coal shown is the cost in the bin, ready for use, but not including the removal of ashes and janitor service.

The demand per 1000 cubic feet contents checks very closely for the three classes of installations when the elements determining demand are taken into consideration. None of the hot air furnaces take a demand lower than 200 cubic feet per hour, and the smaller size

SUMMARY OF HOUSE HEATING DATA - SEASON 1922 - 1923

THE DENVER GAS AND ELECTRIC LIGHT COMPANY

NO.	TYPE OF INSTALLATION	NO. ROOMS	RAD. Sq ft	CUBICAL CONTENTS Cu. ft.	HEATING DEMAND Cu ft	GAS CONSUMPTION HEATING ONLY M. Cu. ft. OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	SEASON	HEATING COSTS GAS RØ CHARGE	GAS TOTAL	GAS MILLION BTU	COAL TONS	COAL TOTAL	COAL MILLION BTU	BTU/Cu ft CONTENTS SEASON	DEMAND 1000 Cu ft CONTENTS Cu ft	HOURS USE DEMAND SEASON	RATIO BTU FIRED GAS TO COAL	COST OF COAL REPLACING MILLION BTU GAS
1	Penna. #20	6		12 000	220	⊙10.3	⊙51.6	53.0	58.1	65.1	56.5	27.9	14.8	337.3	45.90	167.33	1.54	10	108.	0.49	9 020	18.3	1 532	.490	1.00
2	Penna. #24	6		16 500	300	⊙15.9	⊙78.4	91.0	75.7	105.4	87.7	50.0	25.6	529.7	64.80	255.49	1.50	12	135.	.51	10 300	18.2	1 766	.645	0.79
3	High Eff. #23	7		15 550	300	⊙13.2	71.3	85.2	68.5	83.1	68.3	35.3	15.1	440.0	64.80	223.20	1.59	15	150.	.50	9 080	19.3	1 466	.430	1.16
4	Penna. #24	6		14 050	270	⊙10.8	53.9	59.2	53.4	61.9	67.2	32.9	22.4	360.7	55.35	185.20	1.60	No	Data		8 230	19.2	1 316		
5	Popular	5		10 000	265	⊙13.4	46.2	53.0	55.5	67.0	64.2	29.4	19.3	348.0	55.35	180.63	1.61	9	88.	.49	11 170	26.5	1 310	.563	0.87
6	Penna. #24	6		12 000	200	⊙11.5	⊙56.6	73.1	68.4	67.3	58.0	29.3	13.2	377.4	45.90	181.76	1.50	9	100.	.50	10 100	16.7	1 885	.614	0.82
7	High Eff. #123	7		16 000	400	⊙9.7	52.9	56.2	59.4	59.4	62.9	19.9	9.6	330.0	83.70	202.50	1.92	10	150.	.58	6 600	25.0	825	.442	1.31
8	Penna. #24	9		22 000	340	⊙21.3	102.0	116.0	117.0	129.0	120.3	78.4	41.0	725.0	74.25	335.25	1.44	20	175.	.44	10 600	15.4	2 132	.585	0.75
9	Popular	4		5 400	230	⊙7.6	45.7	44.1	38.6	41.3	40.9	24.2	7.1	249.5	55.35	145.17	1.91	7	50.	.42	14 800	42.6	1 083	.812	0.52
10	Penna. #24	6		13 600	300	⊙11.8	⊙59.2	68.7	58.6	68.5	64.5	39.1	23.0	393.4	64.80	206.42	1.63	10	125.	.63	9 300	22.1	1 311	.571	1.10
11	" #24	6		13 000	300	⊙11.4	⊙47.2	55.3	50.5	53.0	46.5	28.3	8.2	300.4	64.80	172.94	1.79	8	71.	.44	7 420	23.0	1 001	.600	0.73
12	" #24	8		24 000	250	⊙11.9	⊙59.5	69.7	57.5	72.9	71.0	38.1	17.0	397.6	55.35	198.49	1.56	12	120.	.50	5 250	10.3	1 590	.533	0.94
13	High Eff. #123	8		22 000	370	⊙17.6	⊙88.0	96.5	94.6	109.1	108.8	52.0	20.9	587.5	74.25	285.75	1.51	No	Data		8 580	16.8	1 590		
14	Penna. #28	9		24 400	325	⊙12.5	64.5	81.9	69.5	81.6	73.6	79.4	10.2	473.2	74.25	223.00	1.63	16	160.	.50	5 420	13.3	1 271	.415	1.20
15	" #28	10		28 000	400	⊙18.6	99.4	111.3	95.1	120.4	109.2	45.5	23.8	621.3	83.70	307.37	1.54	21	225.	.54	7 140	14.3	1 554	.476	1.13
16	" #28	10		27 600	360	⊙15.0	⊙75.0	94.2	82.4	83.5	85.4	45.7	18.6	499.8	74.25	254.18	1.58	16	160.	.50	5 800	13.0	1 382	.513	0.98
	Average Hot Air Inst.	7		17 256	302	13.3	65.7	75.5	75.1	79.7	74.0	40.9	18.1	435.7	69.40	210.29	1.61	12	130.	.50	8 676	19.6	1 440	.549	0.95
17	Hot Water Conv.	8	270	16 650	450	⊙17.5	98.0	100.1	68.2	110.5	90.5	67.2	32.1	584.1	93.15	303.43	1.62	12	120.	.50	11 240	27.0	1 296	.709	0.71
18	" " "	7	315	13 330	400	⊙21.6	117.4	121.7	138.5	98.0	115.8	69.9	36.7	719.6	83.70	342.76	1.49	20	200.	.50	17 300	30.0	1 799	.579	0.87
19	" " "	6	350	15 000	210	⊙13.8	79.5	96.7	85.7	69.9	63.1	33.9	19.0	461.6	45.90	212.08	1.43	16	160.	.50	9 880	14.0	2 198	.463	1.08
20	" " "	7	475	13 000	320	⊙18.0	⊙90.2	96.2	84.0	93.0	108.9	66.9	43.8	601.0	64.80	281.16	1.46	22	200.	.48	14 820	24.6	1 880	.470	1.02
21	" " "	8	535	24 500	450	⊙24.0	122.9	118.3	118.3	133.6	142.7	93.3	47.6	800.7	93.15	381.40	1.48	16	170.	.48	10 500	18.4	1 780	.730	0.66
22	" " "	8	225	14 500	300	⊙12.9	68.2	65.8	60.6	78.6	77.8	45.2	22.1	431.2	64.80	220.03	1.59	11	110.	.50	9 550	20.3	1 437	.630	0.79
23	" " "	8	--	25 500	400	⊙23.0	⊙115.0	112.8	143.5	139.2	129.9	67.2	36.8	767.4	85.70	359.96	1.46	13	200.	.59	9 650	15.7	1 918	.730	0.81
24	" " "	7	787	28 400	500	⊙22.2	132.7	137.1	118.2	120.0	113.5	67.5	30.1	741.3	102.60	369.47	1.55	No	Data		8 375	17.6	1 483		
25	" " "	8	554	19 300	360	⊙13.5	78.7	75.7	69.4	101.8	56.9	39.3	13.6	448.9	74.25	235.85	1.64	20	135.	.40	7 460	18.6	1 244	.425	0.94
26	" " "	10	666	19 000	375	⊙20.5	106.8	152.0	119.4	130.3	92.3	41.0	20.4	682.7	83.70	329.47	1.50	No	Data		11 500	19.7	1 820		
27	" " "	10	725	28 500	450	⊙21.6	⊙108.0	115.8	121.2	123.1	126.4	70.5	35.2	721.8	93.15	353 00	1.52	No	Data		8 120	15.8	1 604		
28	" " "	9	852	26 100	500	⊙24.0	120.8	131.1	134.0	147.3	145.4	69.4	32.3	804.3	102.60	392.15	1.52	20	198.	.50	9 850	19.1	1 608	.645	0.78
29	Vapor "	10	917	51 350	540	⊙26.2	⊙131.0	130.2	137.5	144.8	149.8	100.3	53.1	372.9	112.05	426.29	1.52	No	Data		5 500	10.5	1 625		
30	" "	10	935	40 000	770	⊙32.2	133.6	172.8	175.1	194.2	172.0	118.1	61.0	1 059.0	149.85	531.09	1.56	20	240.	.50	8 500	19.3	1 374	.710	0.70
31	Steam "	12	700	36 600	540	⊙22.0	⊙109.8	135.0	125.0	103.8	120.7	73.3	42.8	734.4	112.05	375.71	1.60	No	Data		6 420	15.2	1 357		
32	" "	18	645	34 000	600	⊙34.9	⊙174.0	189.4	217.5	189.5	169.9	99.1	30.2	1 104.5	121.50	519.12	1.46	30	300.	.50	10 450	17.7	1 841	.592	0.85
	Average Conversion	9	559	23 233	448	21.7	111.7	121.9	119.7	123.6	117.2	70.1	34.8	720.8	92.50	352.07	1.52	17	169.	.49	9 945	19.0	1 642	.603	0.84
33	Bryant	6	451	14 400	280	⊙13.3	⊙66.6	69.7	78.4	91.2	61.3	44.4	18.9	443.8	64.80	224.57	1.58	9	125.	.55	9 900	19.4	1 584	.633	0.87
34	"	7	533	12 450	240	⊙13.5	81.5	73.1	80.9	68.1	69.1	40.0	18.2	449.4	55.35	217.13	1.50	No	Data		11 570	19.3	1 870		
35	"	12	880	38 800	720	16.7	140.6	196.0	167.9	189.4	172.1	89.6	65.8	1 038.1	140.40	514.12	1.54	No	Data		8 560	18.5	1 440		
36	Peerless	15	1 170	47.000	600	⊙35.4	⊙176.8	188.5	199.1	209.8	214.5	111.1	44.3	1 178.5	121.50	545.76	1.45	35	280.	.47	8 040	12.7	1 951	.637	0.74
	Average Gas Inst.	10	758	28 165	460	19.7	116.4	144.1	131.5	139.3	129.2	71.2	36.8	777.4	95.51	375.39	1.52	22	203.	.51	9 517	19.5	1 711	.635	0.81
	Average of all Inst.	9	669	21 124	384	17.8	91.7	102.5	101.2	105.8	99.3	57.2	27.6	600.4	80.55	296.08	1.56	16	158.	.50	9 611	19.1	1 559	.579	0.89

⊙ indicates consumption calculated on a temperature basis.

AVERAGE MONTHLY TEMPERATURES

Season	Sept	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Average
1918 - 1919	59.1	54.6	36.6	30.6	34.2	31.[illegible]	40.8	49.1	57.9	43.65
1919 - 1920	64.4	46.4	34.0	33.0	34.0	32.6	37.8	38.8	57.0	42.28
1920 - 1921	62.5	52.2	36.7	31.5	33.8	37.0	45.0	45.2	57.5	43.48
1921 - 1922	63.9	56.0	43.7	35.4	27.7	31.4	40.[illegible]	45.2	57.7	44.58
1922 - 1923	65.9	52.8	37.2	35.1	37.9	28.2	33.9	46.6	56.1	43.73

furnace will take care of buildings up to 9,000 cubic feet; consequently, small houses have a large ratio of demand to cubical contents. In conversion jobs, orifices smaller than 3/16 of an inch are not advisable, and since the coal-fired boilers, are as a rule, larger than needed to heat the home, the number of burners to give best results is greater than necessary to burn the required amount of gas; consequently, the demand is higher and the heating period shorter than in gas-designed equipment. There were, also, a few customers who desired a quick response from the heating system and were more concerned with service and convenience than in careful control and costs of operation. In these cases abnormal demands were permitted.

The B.t.u. fired, per cubic foot contents per season, was calculated from the total B.t.u. input, divided by the measured cubical contents. The averages of the three classes, hot air furnaces 8,676, conversions 9,945 and gas boilers 9,611, are in the order naturally expected. The wide discrepancies among individuals of the same class can be assigned to a number of causes. To analyze the situation, the condition of the house must be known. Another important factor is the human element. The number and ages of occupants, their personal habits, and social activities, have an important bearing on the heating operation. The ventilation is very important, and the fact that all of the house is used, or whether certain rooms are shut off from the heat a greater share of the time.

The ratio of B.t.u. fired, gas to coal, gives a good idea of the actual utilization of heat from the two fuels. Hot air furnaces give the lowest ratio and gas-fired boilers the highest. However, only two values could be procured for the latter, so the figures cannot be taken as an exact indication.

The cost of heating with gas averaged $1.56 per million B.t.u. input, while the cost of heating with coal was 50 cents per million B.t.u. input. However, when placed on the same basis of actual heat utilized, the cost of coal replacing one million B.t.u. of gas averaged 95 cents for hot air furnaces, 84 cents for conversions and 81 cents for gas boilers, or a general average of 89 cents for coal against $1.56 for gas.

In calculating the heating costs with coal, no charges for removal of ashes or janitor service have been considered. In some cases, where a fireman was employed, the actual cash cost of heating the home, per season, with gas has been very close to the costs with coal. There are a number of intangible savings resulting from the use of gas, which can be properly considered, such as cleanliness, economy of space, ease of control and constant temperature, with resultant better health conditions.

The hour's use of demand, per season, is found by dividing the total consumption by the demand. The average for the hot air furnaces was 1,440 hours out of the total 5,856 in the season, while that of the conversions was 1,642 hours, and the gas-designed boilers 1,711 hours, with an average for the 36 installations of 1,559. This gives an annual load factor of 17.8 per cent.

Some of the more important problems, which have confronted us during the past season, are those of demand, temperature control apparatus, the selection of a suitable hot air furnace for local conditions, and an efficient

method for conversion of hot water and steam boilers.

Our experience has been that it is to a common interest to help the customer to lower his demand, by explaining, in detail, what the demand part of his charges mean and how he can lower that demand by the variation of the time of using the gas appliances. This not only gives to the customer a decrease in his demand charge, but gives a better load factor on the distribution system as well. It is expected that it will be possible for the customer, in a number of cases, to get along with a lower demand when suitable conditions are established.

Next winter, we expect to install demand limiting meters which may permit the demand to be reduced, particularly for those customers having a large demand in proportion to their consumption. Just how far this can be carried will be different in different cases.

As pointed out before, some customers are more concerned with the unlimited availability than with the cost of operation. It would not be policy, of course, to hold such customers down to as small a demand as other customers who might wish to economize. A correct demand charge, in a three-part rate, adequately pays us for taking care of this demand.

The control of installations has a definite effect in computing the peak demands on mains. Approximately 90 per cent of the heating systems are thermostatically controlled, and when the temperature drops to the predetermined point, the gas is turned full on. When the temperature is raised the desired number of degrees, the gas is turned completely off. Quick acting valves with positive action are used. This means that, at all times during the heating season, the demand is either maximum or zero. It is estimated that, in the coldest period of a severe winter, the house heating appliances will average twenty hours daily operation, which requires a distribution system adequate to supply at least 85 per cent of the summation of the individual peak demands. Thermostatic control gives a reasonable diversity of demand, especially in milder weather. Manual control, permitting partial opening and closing of valves, may be advantageous in that a greater diversity would result, although the houses are permitted to become cold at night, with a resultant heavy load coincident with the domestic breakfast peak.

The problems confronting us on the hot air furnaces are the lasting qualities and the thermal capacity of the material used. From experience gained by other companies, and from an analysis of our own peculiar local conditions, we have decided that an all cast-iron furnace will be the one to best meet our requirements.

It was necessary, for the rapid introduction of gas house heating, to keep the first cost of equipment as low as possible. In order to do this, the present coal equipment had to be used, and suitable gas burners and auxiliary equipment inserted. This proved a failure on hot air furnaces, but after considerable experimental work had been done along this line, an efficient method for conversion of hot water and steam boilers was worked out. This made it possible for us to put 92 customers on the line during the past season, of which only seven have been taken out, due

principally to the factor of the human element.

The wide range of customers using gas heating is best illustrated by pictures of representative installations. The variety of uses to which old coal rooms are put is interesting. The majority of people have their basements cleaned and decorated throughout, as soon as the heating system is installed.

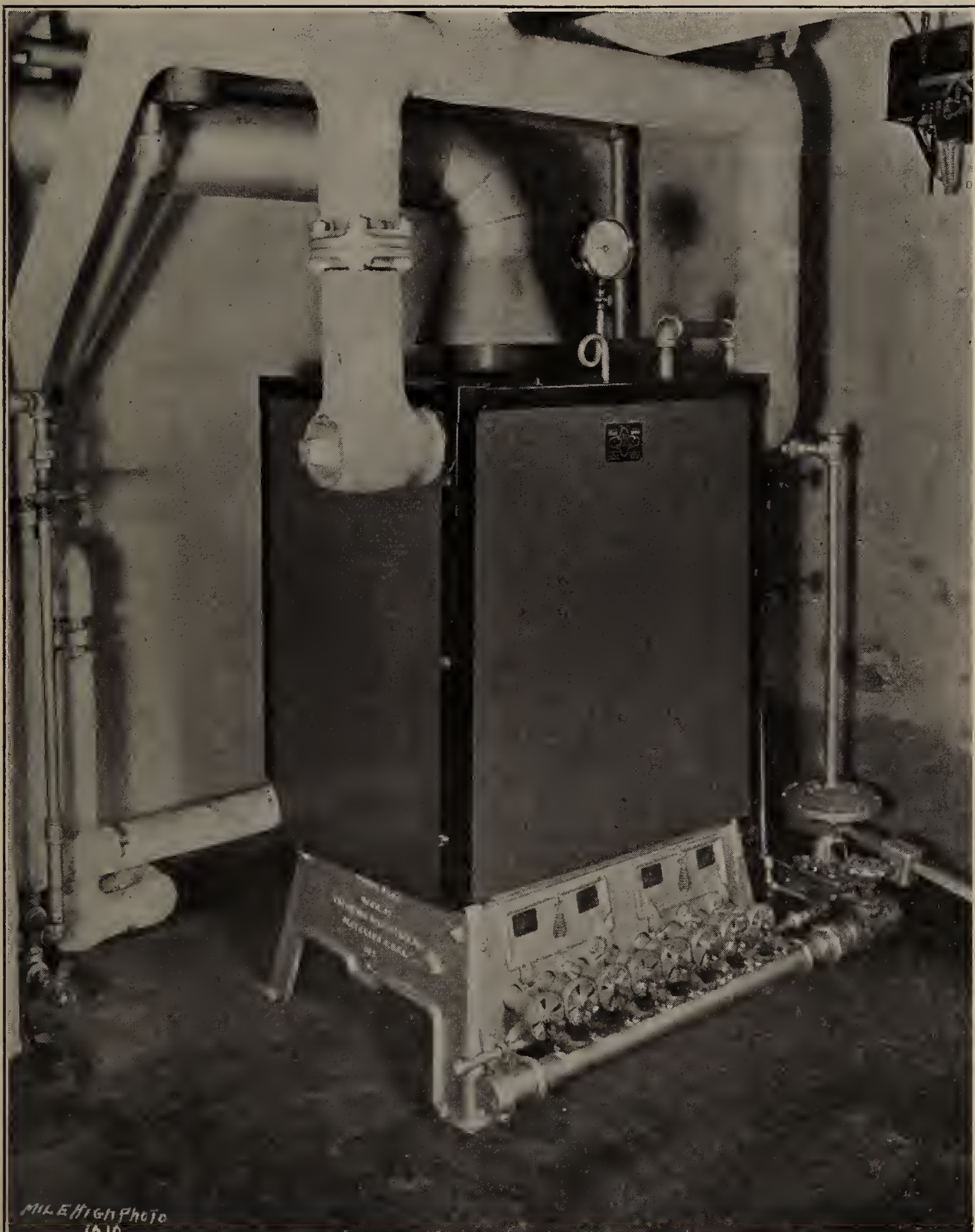


Figure 9—Figures 9, 10 and 11 show the gas-fired boiler, the renovated coal bin; and home of Dr. E. F. Dean at 180 Marion Street.

Figure 10.

Figure 11.

Figure 12—Figures 12 and 13 show the home of A. R. Wilfley, 1300 High Street, and the gas-fired boiler in tandem with the old coal boiler. The latter is to be taken out before fall. A striking relation in the size of boilers for the same duty is shown in this picture.

Figure 13.

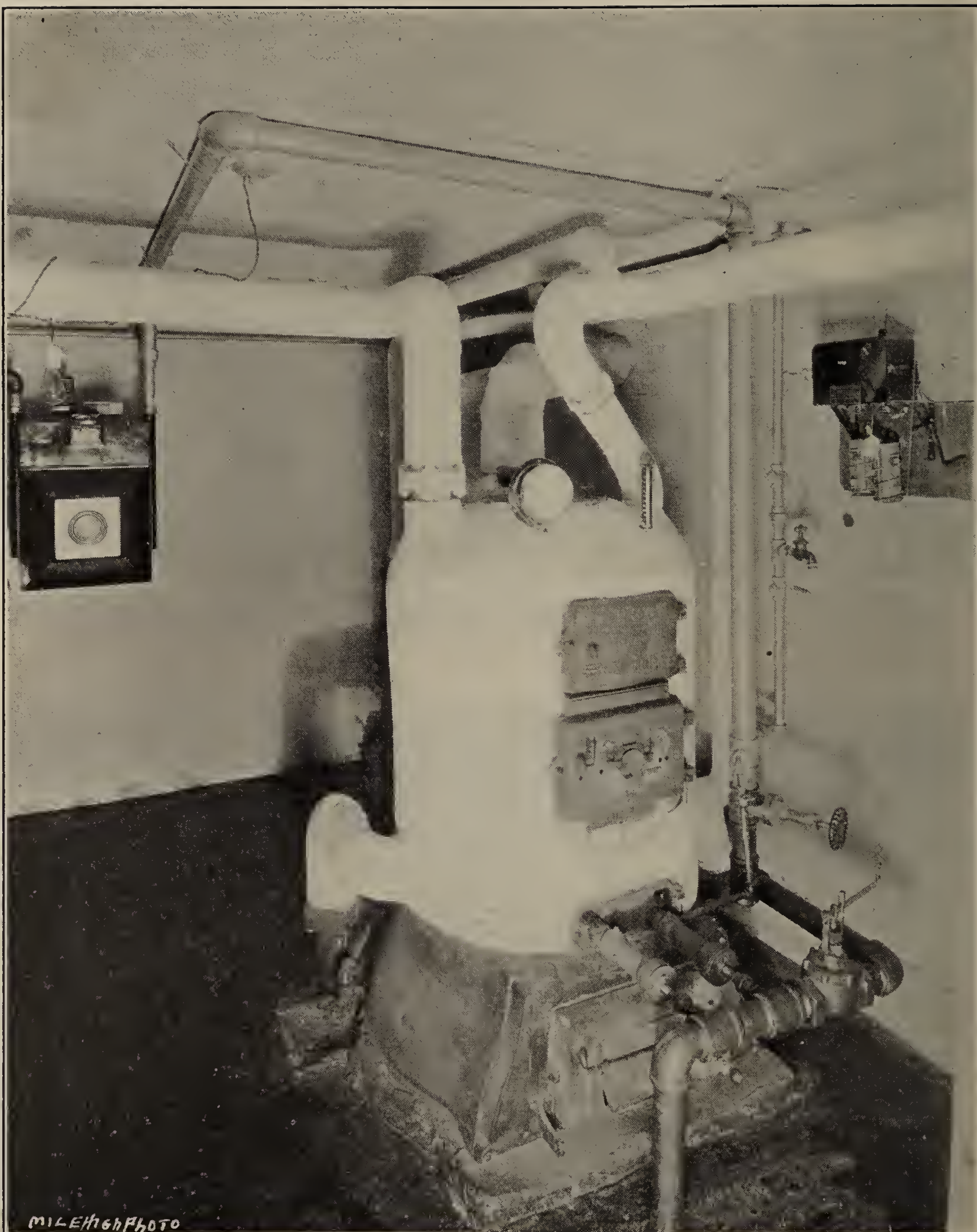


Figure 14—Figures 14, 15 and 16 show the round boiler conversion, the shower room replacing the old coal bin, and the home of Dr. Lingenfelter, 300 Marion Street.

Figure 15.

Figure 16.

Figure 17—Figures No. 17 and 18 show Charles Starkloff's home at 1545 Gilpin Street, heated with a sectional boiler conversion.

Figure 18.

Figure 19—Figures 19 and 20 show the home of E. M. Troxel, 3804 Alcott Street, who has modernized his home with a small compact gas-fired hot air furnace.

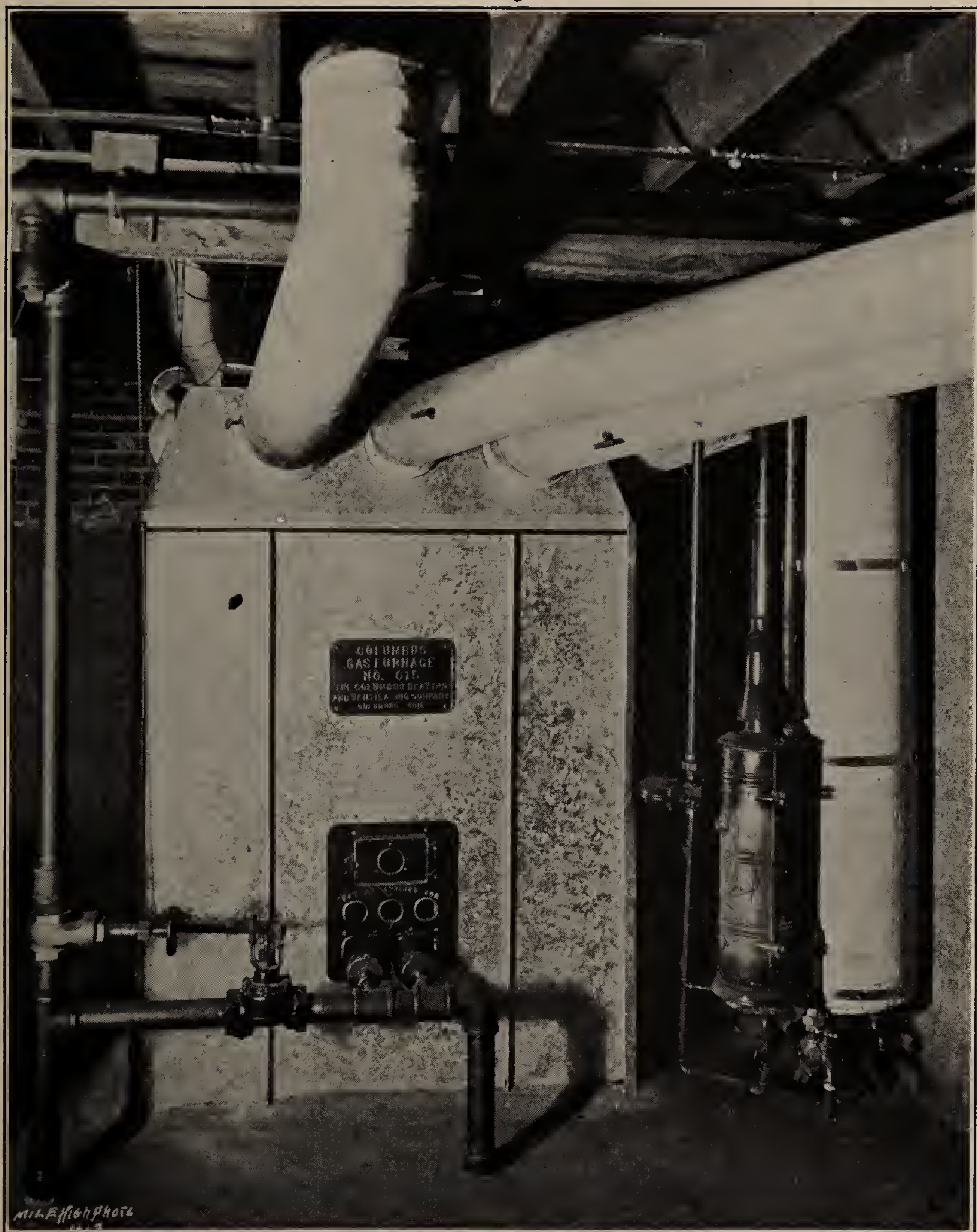


Figure 20.

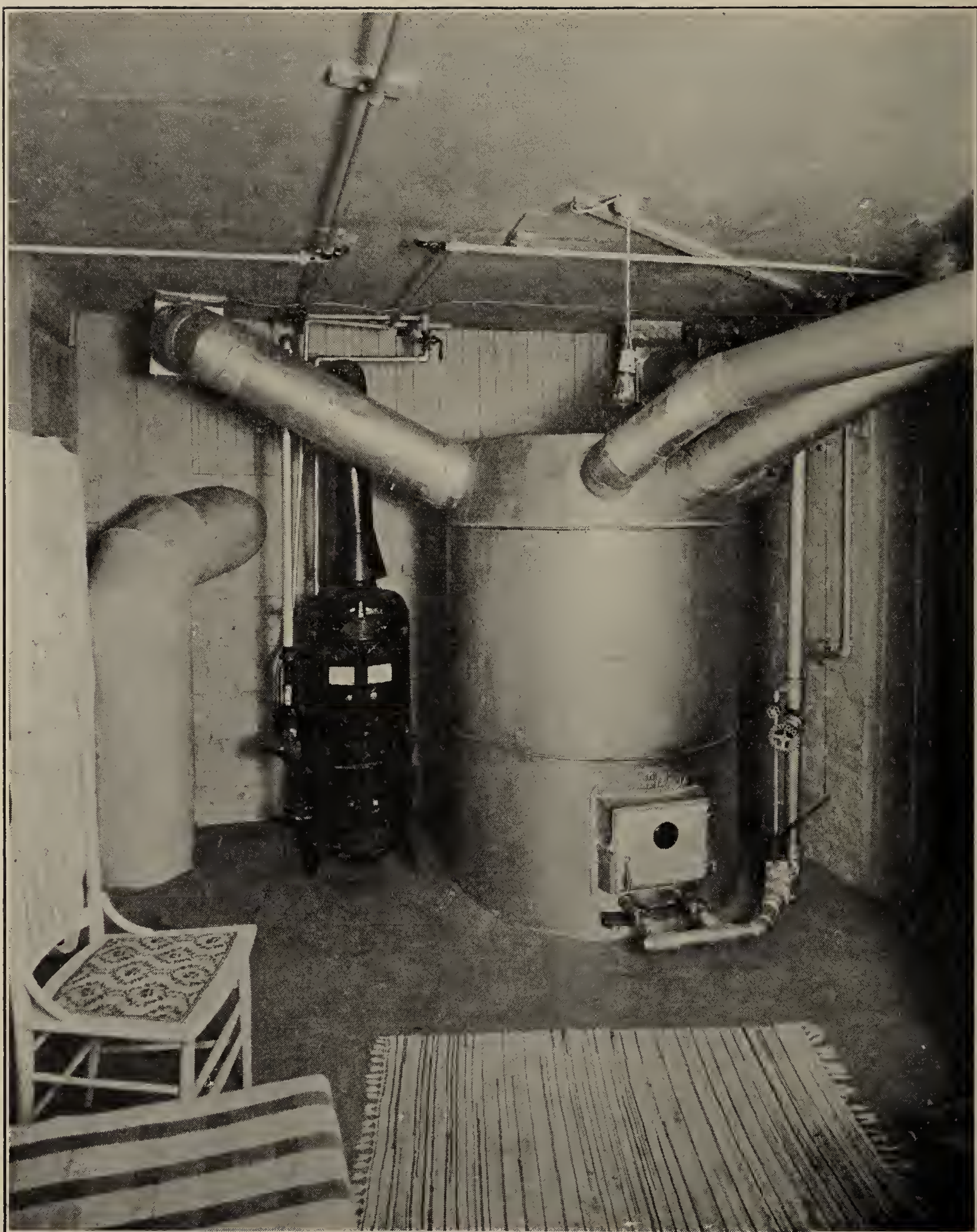


Figure 21—A very clean furnace room. The three part rate has a big inducement to remove the instantaneous water heater pictured here.

Figure 22—A display of heating equipment used in the "Better Homes" Exposition, which speaks for itself.

E. P. Bailey (Cleveland, Ohio): We are indebted to the Denver Gas & Electric Light Company for demonstrating one fact that has been more or less argued during the last few years. I believe they have pretty conclusively proven there that there is a large diversity factor and that the house-heating load is not such a terrible thing as it has been painted.

I notice that the authors have taken for comparison the cubic contents of the building heated. With a building thirty feet wide and thirty feet long the perimeter of the house will be 120 feet. Now, assume a house with the same height of ceiling, that is 15 feet wide and 60 feet deep. The perimeter of that wall will be 150 feet; in other words, 25% greater wall surface, and probably the same proportion of window surface greater, than in the case of the square house, although the cubic contents are the same.

To figure the heat losses in each particular instance and reduce them to terms of square feet of radiation or leave them as they are in B.t.u.'s per hour, would give a much safer basis of comparison. For instance, figuring the hot water conversion job—you will note from the table that the consumption of B.t.u.'s per cubic feet of contents varies as much as 100 per cent from the low job to the high job.

You will find the same variation probably in converting that into terms of radiation. But note the difference in making this comparison with the gas-designed job. Figuring that in cubic feet of gas per square foot of radiation, the average hot water conversion requires 1366 cubic feet. That is cubic feet per square foot of hot water radiation per season. The average of Nos. 33 and 34, which are two water jobs, is 913; 913 as compared to 1366.

Now that is some indication of the relative efficiencies of the jobs, although the small number of them does not make that an entirely safe comparison. In the same way job No. 36, which shows a smaller consumption, smaller B.t.u. demand per cubic foot of contents per square foot of radiation, shows 1025 against 913 for 33 and 34, or a little more than 10 per cent greater.

You also have to carefully watch the type of radiation. I happen to know that job No. 35, which is listed with the others as a gas-designed job, is not a hot water job but a steam job. It is obviously unfair or misleading to compare results on a steam job, where the emission from the square foot of radiation is 250 B.t.u.'s per hour, with the hot water job where the average or the maximum emission very often does not run over 160 B.t.u.'s per hour. So although you get 1180 cubic feet of gas per square foot of radiation per season, you are doing about 60% more work with each square foot than you are with the hot water job.

The heating demand, I think, in terms of cubic feet of gas per hour, is remarkably low on these jobs, and it is not at all in proportion to what we have been led to expect from data which has been presented to this and other bodies before.

I do not think that the house-heating business is anything to frighten anyone in the manufactured-gas field. The expense of installing house-heating apparatus for gas consumption, the price of gas in comparison to other fuels, especially coal, which is the popular house-

heating fuel, is so high that you will have no rush of that business on your lines. However, I think it has been demonstrated in Denver that it is a load, which if properly charged for will bring excellent returns, and one which I venture to predict will become more and more popular as the years go by.

J. D. MacArthur (Jersey City, N. J.): What is the relative efficiency of the coal-fired boiler compared with the gas-fired boiler?

T. M. Foulk (Denver, Colo.): You mean as they are operated, one a gas and the other a coal-fired boiler?

J. D. MacArthur (Jersey City, N. J.): Yes.

T. M. Foulk (Denver, Colo.): The average efficiency of the gas boiler is in the neighborhood of from 75 to 85 per cent, depending on the type of boiler and adjustments of the installation. The average boiler using coal probably has an efficiency of 45 to 55 per cent.

A Member: What is the average cost of coal in that test that was made? And what was the average amount that the people paid for gas during the heating season?

T. M. Foulk (Denver, Colo.): The average cost of coal, as given by the customer, varies all the way from \$4.75 a ton to as high as \$15, and the average, I should judge, would be around \$8. I have not averaged up the costs given here on this particular table.

The Chairman: It so happens in Denver that there is a wide range of costs of coal because of the great diversity of grades that the people use. There is a local lignite outside of Denver that is to be bought very cheaply, about \$5 a ton, and others use semi-anthracite and things like that that cost up to \$15 a ton.

REPORT OF THE COKE COMMITTEE

V. A. Miller, *Chairman,* Rochester, N. Y.

It is the consensus of opinion that the principal effort of this Committee should be to impress gas companies with the intrinsic value of their coke as a domestic fuel and the more important considerations as to sizing, handling, etc., in order to make their coke adaptable to the domestic market.

The American Society for Testing Materials gives the following tentative definitions of terms relating to coke:

Domestic Coke—The smaller screened sizes, below approximately 2½ inches, suitable for use in domestic stoves, heaters, etc. The standard sizes are quite generally sold under the names given below and the screen sizes are average, although locally varied somewhat.

Name	Screen Size	
	Passing	Retained on
Egg Coke	2½ inch	1¾ inch
Stove Coke	1¾ inch	1¼ inch
Nut Coke	1¼ inch	¾ inch
Pea Coke	¾ inch	½ inch

It might be well to mention before proceeding further that the above nomenclature of domestic coke sizes has been the cause of considerable discussion, the debatable question being the advisability of the continued use of the anthracite trade terminology, or whether new nomenclature should be coined for use in promoting the sale of Domestic Coke. It has been suggested that the following nomenclature of sizes would not lead to confusion among users as would a system of numbers:

Domestic—Large
" —Medium
" —Small

However, it was decided that the nomenclature used in the anthracite industry be retained for the various coke sizes as any change would be most confusing to customers who have been accustomed to purchasing according to the anthracite nomenclature.

The sale of coke for domestic purposes is not unlike the sale of gas in some respects, viz:—the utilization of storage, investment, territory to be served, etc.

The demand for coke for heating purposes is seasonal. Therefore, unless the coke were sold and delivered at a rate approximately that of production, it would be necessary to have considerable storage space and a very high investment in equipment to handle a year's production during the months when it is in demand. If it were not for this, the sale

of coke would be comparatively simple, inasmuch as its advantages are becoming quite generally known.

For the past eleven years the average yearly production of anthracite coal has been approximately seventy million tons, and this year in one of the greatest states of the Union a bill was introduced in the legislature which would permit adulteration of 20% in anthracite coal of smaller size than chestnut. The bill would permit chestnut coal to contain 11%; stove coal 7%; egg coal, 4%; and grate coal, 3% of slate, limestone, slag and other foreign substances. The measure provides that it shall be a misdemeanor to sell coal with adulteration greater than these limits. To use the proverbial saying, it ought not to be difficult to read the "Handwriting on the Wall." Without attempting to ascertain the real reason for such legislation, we will assume that it is due either to a diminishing supply or a marked falling off in the quality of anthracite coal.

As stated before, the demand for fuel for domestic purposes, particularly coal and coke, is seasonal, depending to a great extent on average climatic conditions in different sections of our country. This factor alone is the cause of most of the difficulties in the fuel trade; labor and transportation difficulties especially.

In a recent issue of a coal trade paper, Mr. F. R. Wadleigh, chief of the coal division of foreign and domestic commerce and federal fuel distribution, recommends:

"That householders would benefit from the fact that they are likely to get cleaner and better prepared coal in warm weather, due to less breakage from handling; the coal would also contain less moisture and the dealers would often be able to deliver direct from railroad cars to consumers' bins.

"It is suggested that it might be advisable for dealers to start a campaign after April 1st, to at least obtain orders from their customers, the coal to be delivered when called for and available. The fact that most consumers' bins are likely to be empty at that time should be further incentive to early buying.

"Storage of coal should, to have the greatest usefulness, be as near as possible to the point of actual consumption which, in the case of fuel for domestic use, is the householder's cellar bin."

It would be a waste of time for this Committee to delve into the economic disadvantages due to the inequality of demand through the year. However, there are a few points which should be drawn to your attention in connection with the production and sale of coke from a gas plant.

First: That unless you make an effort to equalize your sales and deliveries so that you can operate at approximately 100% load factor, your problems will be similar to those of the great transportation lines. They, as you know, have the nation's fuel supply to transport at a time when the nation's production of manufactured goods requires transportation in addition to crop movement.

Second: It is true that the customer will receive better fuel if he permits his fuel bins to be filled during the spring and summer. The distributor of fuel will also benefit to the extent he is able to utilize his organization and equipment, and to the extent of the losses eliminated due to the storing and recovery of coke.

Now as an inducement to overcome the inertia of the fuel buying public, why not give them all or at least part of the saving effected due to the better load factor on your equipment? This can be done and has been done.

Let us cite a specific case of a company catering exclusively to the domestic trade. We have chosen the year 1921, as this represents what might be called a normal year, but, as some of you coke men know, the country was then in the throes of an industrial depression. To give you an idea as to the condition of the coke market, we will quote from the Black Diamond of June 11, 1921.

"Furnace coke is around $3.50 and $3.75 with some sales made at $3.25. Foundry coke runs from 50c to $1.00 per ton higher with the demand for either negligible and no contracting being done."

Stove size anthracite coal was selling for $12.85 and coke for $12.00 delivered.

The price of coke was reduced $1.50 per ton to $10.50 and during that year the coke sold from that plant netted the manufacturing department $8.247 per ton.

The minimum tonnage delivered during any month was 6.8% during May, 1921, while the sales organization was being perfected; the maximum tonnage delivered, 13.0% during September. The relatively high percentage delivered during September was due to accumulated orders taken during the summer months, as it was the aim of the sales organization to keep at least twenty days ahead of the trucks and during September the regular delivery equipment was augmented by hired trucks and teams in order to be ready for any seasonal demand which might occur.

During the same year some of the companies who were catering exclusively to the industrial trade were badly pressed for storage space and many thousands of tons of coke remained in storage, due to the fact that the domestic market had been overlooked.

The domestic market is not always as attractive as it was during 1921 and there are times when the promotor of coke as a domestic fuel is greatly tempted to cater to the industrial trade, particularly when the Connellsville market is quoting prices ranging from $18.00 to $22.00 per ton f.o.b. point of origin.

It can be said, however, that the domestic market in a northern latitude is far more stable than the industrial market, and, if properly developed, should not be abandoned for the occasional higher prices to be obtained in the industrial market.

In developing a domestic market for coke in a territory where the chief competitive fuel is anthracite coal, the potential coke market includes, primarily, the same heating devices in which the competitive fuel is used. In view of this fact, the sizing of coke for the domestic market is of primary importance. It might be argued that the quality of coke is of primary importance, but no matter how high the quality of coke, it cannot be successfully burned unless it is properly sized for the appliance in which it is to be utilized.

In order to emphasize the importance of coke sizing, the Committee has interviewed several large manufacturers of house heating and cooking appliances relative to changing the design of some of their heaters and stoves to make them more adaptable for the use of coke.

The Committee learned that coke was well thought of as a domestic fuel by these manufacturers and that many of their appliances are already adapted to burn coke when properly prepared to suit the particular appliance, but generally speaking, their experience was that "coke had been so inadequately prepared that they do not care to recommend its use."

It was distinctly intimated that the gas-man "must first put his house in order" by properly preparing his coke in order to enlist their co-operation. When this becomes general, the manufacturer of domestic heating appliances will gladly remodel his appliances where desirable and will recommend the use of coke in advertising their appliances.

If the coke is properly sized so that it can be burned efficiently, but is of such poor quality that it does not compare favorably with the chief competitive fuel, difficulty in marketing our product will be met on that account. So it behooves the Gas Property Manager to diligently guard the preparation and quality of his product if he is to successfully develop the domestic coke market.

Now that the preparation and quality of our product is as good as it is possible for us to have it, we must give service if we are to be successful. Service is a small word but it includes everything from the sale to the utilization of our fuel.

Sale:

One of the first questions asked by the prospective purchaser of coke in the undeveloped market is, "Does coke burn out the grates?" The answer is emphatically—No. There are only two ways by which the grates in a furnace can be burned out, and both are due to the negligence of the operator. One way is to permit the ashpit to become filled and the other is to leave the grates in the wrong position allowing the prongs of the grate to project into the fuel bed. The most skeptical can be convinced of this point. If the grates are compared with the radiator of an automobile and the air supply to the radiator is restricted or shut off entirely, it isn't long before the water is evaporated and the engine stops for the want of a cooling medium. Just so with the grates of a heating appliance. Restrict the air supply through the grates or create a condition whereby the heat cannot be conducted away from the grate and the grates are ruined.

With the grate question settled, the next inquiry will undoubtedly be: "How does it compare with coal and how much coke will I have to buy if it takes ten tons of coal to heat my house?" If the quality of the coke has been maintained and the customer will follow the simple instructions for its use, the customer will actually require less coke than coal, but it is better to advise the purchase of the same amount. For if, at the end of the season, the customer has had better results than you predicted, it will not require much sales effort to get his order for the next heating season.

It is really surprising how few purchasers of fuel know the size of the firepots of their heaters. There are some who do not know the size of coal which they use, and in case the consumer is unable to answer either inquiry, it is quite necessary that conditions should be investigated before any size is recommended.

Sizes:

This brings us to the question of screen sizes. While it is not within the province of this committee to attempt to establish standard screen sizes, we believe that the sizes shown on page 10 of the Appendix, with reasonable tolerances to meet local conditions, will be very satisfactory. General practice seems to place three sizes as a minimum, viz: Egg, Stove and Nut. From the standpoint of the operator, of course, it is of advantage to keep the number of sizes to a minimum and some companies report the sizing of only two sizes, viz: Range and Furnace, with entire satisfaction to all concerned.

Under some circumstances Pea size would be in demand, as there are a great many kitchen ranges and very small heaters which require Pea size coal for satisfactory operation. This last size is debatable inasmuch as the same sales effort would probably place a gas consuming device in place of the present heater unless it was depended upon for house-heating.

The fewer sizes necessary to meet existing conditions, the less complex will be the sizing, storage, sale and delivery problems. Before it is decided to have a Pea size, give these suggestions careful consideration.

Recommend Uses for Different Sizes

First:

Nut size—for kitchen ranges and small stoves.

Stove size—for medium size furnaces, steam or hot water heaters.

Egg size—for large size hot air, hot water or steam heaters.

Second:

Nut size—for ranges, base burners, laundry stoves, Spencer heaters, and furnaces with firepots 20" or smaller in diameter.

Stove size—for furnaces, steam heaters, and hot water heaters having firepots larger than 20" diameter.

Egg size—for very large steam and hot water plants.

Pea size—

As stated before, it has been the experience of some companies who have relied exclusively on the development of the domestic coke market for the disposal of their product that there are quite a number of kitchen ranges with very small firepots and other small heating appliances which require the use of pea size anthracite coal for satisfactory operation. We wish to caution you that where a pea size of coke is not available to meet this competition, the nut size coke should not be sold for use in such appliances. However, the tonnage is so small that it is not worth the effort and expense to meet this competition.

It might be helpful to mention that one company, disposing of approximately eight thousand tons a year to the domestic trade, reports the following percentages as to sizes:

Egg	2.3%
Stove	78.5%
Nut	19.2%
	100.0%

Another company selling approximately fifty thousand tons a year to the domestic trade reports the following percentages as to sizes:

Egg	20%
Stove	50%
Nut	30%
	100%

As stated before, too much stress cannot be laid on the fact that satisfactory operation with coke depends primarily on correct sizing. It makes but little difference whether the sizing is correct if slipshod methods are employed in recommending the proper size. If, after questioning the prospective customer, you are still in doubt as to the proper size, send a competent representative of your Coke Sales Department to inspect the appliance in which the coke is to be used. This you will find is good business, and if you guarantee satisfactory results with coke, you will find it much cheaper than to remove the coke after having delivered the wrong size.

In the undeveloped market every effort possible should be made to acquaint the purchaser with the proper use of coke. This instruction should begin when the first sale is made. Make your verbal instructions easy to remember, and sup-

plement them with a booklet so that the customer can refresh his or her memory.

In order for the customer to understand your instructions the sales person should explain that, pound for pound, coke has as much heat as anthracite coal and about half the volume of ashes; also, that when a ton of coke is delivered, it requires about sixty cubic feet of bin space instead of approximately forty for coal. This mental picture of the relative volumes of the two fuels will be of great assistance in convincing the purchaser that it is necessary to use six shovelfuls of coke instead of four shovelfuls of coal to get the same amount of heat into the heater.

About 90% of the householders using anthracite believe that it is more economical to have a shallow fire under strong draft than a deep fire under very little draft. If this belief can be corrected in connection with the use of coke, and the consumer convinced that his furnace or heater should be filled full and the fuel utilized at a slow rate of combustion, the battle is more than half won.

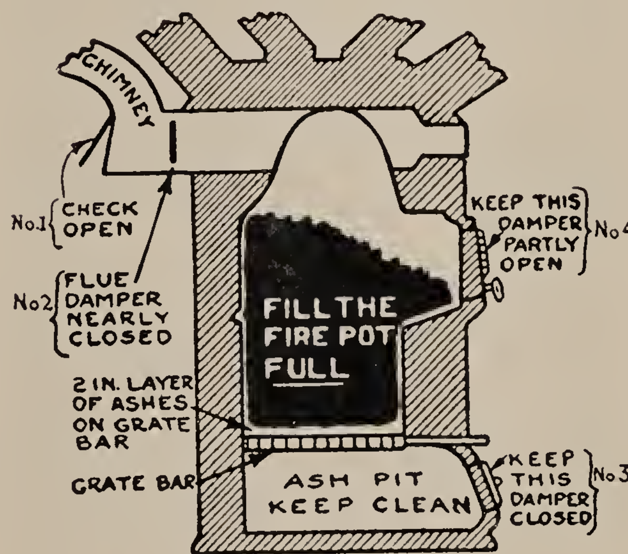
The relative volume of ashes should be dwelt on to some extent also. If the coke contains half the volume of ash as compared with anthracite coal, the heater will require but half the amount of shaking.

For some reason the majority of fuel users delight in shaking the grates often and vigorously. Too much advice against this practice cannot be given, especially with coke on account of the smaller volume of ashes as compared with hard coal.

The shaking operation should be stopped when a glow is seen in the ash pit. There are two very good reasons for this. If the shaking operation is continued, hot coke will drop in the ash pit, and these hot bits of fuel represent unconsumed carbon. If the shaking operation is stopped as suggested, about two inches of ashes are left on the grates, which is very helpful in regulating the draft. This method eliminates the necessity for screening the ashes. It is quite necessary to emphasize that the above is done to save fuel and to obtain better draft regulation and not to protect the grates.

If the foregoing instructions are carefully followed, as to the proper size and methods of firing, the customer will soon learn the right length of time the heater should be left on draft before checking.

There should be four dampers or checks for the regulation of the fire, as shown in Figure No. 1.



DON'T FORGET
It is the operator and not the fuel that damages the grates.

Fig. 1

While the illustration shows a hot air furnace, the following explanation of the use of the dampers applies equally as well to hot water and steam heaters.

The usual names and locations are as follows:

No. 1—Check damper, located in flue pipe to chimney.

No. 2—Flue damper, located between heater and check damper.

No. 3—Draft damper, located usually in ash pit door.

No. 4—Feed door damper, located in feed door.

Functions:

No. 1—By opening the check damper, cold air is admitted into the flue pipe, thereby reducing the chimney draft and retarding the combustion of the fuel in the heater.

This damper should be closed tight when the grates are shaken and when fresh fuel is added. It is usually equipped with a chain leading to some convenient point so that it can be operated without going into the cellar.

No. 2—The flue damper is particularly valuable for a chimney with strong draft and it gives much more effective control than is possible with only a check draft. The correct location is between the heater and check draft and not between the check draft and chimney. This point is important.

No. 3—The draft damper is usually a lift door in the ashpit door, and through this the air is admitted to make the fire burn. It is usually equipped with a chain leading to the same convenient point as the chain from the check damper, as these controls are most frequently used.

No. 4—The feed door damper is usually in the form of a slide which opens or closes two or more openings in the feed door and is much more important than most people suppose. If the heater is run efficiently, that is, with a deep fuel bed, this damper, if properly adjusted, admits just sufficient air to supplement that admitted through the draft damper in the ash pit. This adjustment is worthy of considerable attention as it permits more perfect combustion by supplying the necessary air to burn the combustible gases liberated by the fire. If it is opened too much it acts as a check; if too little, the unburned gases go up the flue with a resultant loss of heat.

The prospective new customer usually wants to "try a half ton" to ascertain whether it will be satisfactory in his heater. For this reason, it is advisable to guarantee results and not sell in less than ton lots. In other words, insist on the customer purchasing at least a ton and if, after following the instructions as outlined in the coke booklet you have given him, he is unable to get satisfactory results, offer to send a demonstrator to show him how to care for his heater in the proper manner. If the demonstrator is unable to give him satisfactory operation, you should be willing to remove the coke from the customer's cellar and refund his money on the basis of the amount removed.

One company has printed the following guarantee on their coke booklet:

OUR GUARANTEE

If practical demonstration by our representative in your home does not convince you that Guaranteed Coke is the best and cheapest fuel, we will remove the coke from your cellar and refund the money for the amount removed.

What could be fairer than this? It certainly is a big factor in convincing the customer that coke is a superior fuel and unless you are willing to stand back of your product, you cannot expect the customer to assume the risk.

Delivery:

The delivery problem is one which should be given serious consideration and varies with each locality. No matter how good the quality of your product or how well it is prepared, if the delivery to the customer is not made with reasonable

promptness and in a workmanlike manner, your service is incomplete.

Some companies rely entirely on contractors for the delivery of their product, while others have their own delivery system with enough equipment to take care of the average daily production of their plant, and contract or hire during seasons of peak demand.

Companies having a comparatively small tonnage to dispose of can usually find a reliable contractor who will give good service at a much lower cost than is possible by the operating company. Operating companies with large tonnages who furnish their own delivery service have the advantage, from the standpoint of service, of complete control of all operations pertaining to the sale, delivery and utilization of this important product.

There are so many factors entering into the delivery problem that it could well be made the subject of a whole paper.

The location of the plant from which distribution is made is usually a controlling factor, which naturally brings up the question whether it would be cheaper to establish yards from which general distribution can be made or deliver direct from the manufacturing plant.

In some municipalities it is permissible to dump fuel at the curb and the purchaser attends to the housing problem, while in other communities the housing problem is attended to by the seller. In the first case it might be highly desirable to employ dump trucks carrying at least five ton loads; while in the latter case three ton trucks would be more economical as in many instances consumers have driveways which can be utilized by the smaller trucks and the coke shoveled directly into the bin, or in many cases to shorten the length of the carry.

Everything possible should be done to cut down the idle time of truck equipment, as this is one of the most expensive factors of truck operation. Trucks should always carry their full loads and in the case of split loads too much attention cannot be given to the routing of orders. In the majority of cases the selection of orders and the despatching of delivery equipment is entrusted to one or two men on account of their knowledge of the territory served. This is entirely wrong in large communities as it is not humanly possible for anyone to remember the exact location of all streets, to say nothing of selecting the proper orders to go on a given load. This can be greatly simplified if the delivery district is divided in say half-mile squares, and an index devised to cover all the zones in the delivery district.

In one city, having a population of 300,000, such a system has been in operation for three years and has been the basis, not only of routing orders and despatching delivery equipment, but of analyzing location of sales as to territory.

When a coke order is taken, the salesperson refers to a visible index which covers all the streets in the territory served, and records on the order book the block in which that particular address is located. All orders in that half mile block naturally have the same code letter and number and when the orders are sent to the yard for delivery they are arranged and filed for delivery according to the code letter and number. Of course, a cabinet is provided with pigeon holes for each block and when the despatcher takes orders from a certain pigeon hole he knows that every order in that pigeon hole is within one-half mile from any other order. Often, he is able to send out three separate orders on the same load that are within a few hundred feet

of each other. All orders delivered are tabulated according to the code letter and number and in this way the distribution of sales is ascertained in respect to the center of distribution.

If a company decides to deliver its own product, too much study cannot be given to delivery equipment and whether a manufacturer's service station is maintained in your locality for the particular truck or trucks you decide to use. It is impossible to use all the different makes, so standardize on one or two, preferably two, and your truck maintenance will be greatly simplified.

Do not neglect the tools, such as shovels, baskets, basket irons and boards, lawn and house canvasses and brooms. If you want your drivers and helpers to do good work they must have good equipment.

Hold meetings on company time of your drivers and, in fact, your whole coke organization. Discuss accidents, property damage, complaints from customers, in fact, everything pertinent to the delivery of coke to the complete satisfaction of the customer, if that is possible. Don't miss an opportunity to compliment any of your men for conspicuously good work and eventually you will find they will want you to inspect some of their most difficult jobs. Do it. It pays big dividends. If a customer compliments you on the workmanlike manner in which you have effected a delivery, pass it along to the men who actually did the work and be sure the other drivers know it too. You will get more compliments and fewer complaints.

Erect a blackboard in a conspicuous place on which you record daily the tonnage delivered by each truck. Most crews, if they are the men you want to keep, will keep you informed why their tonnage delivered was below the average.

Last, but not least, pay your drivers and helpers what they are worth and you will be amply repaid through the better service you are able to render your customers.

The foregoing is also true in connection with your Salesmen-Demonstrator forces. If you are going to sell your product to the Domestic Trade and attempt to equalize your sales and deliveries throughout the year, it is quite essential to have dependable men. These men are necessarily year-round men and are used during the heating season to instruct customers how to handle Domestic Coke to obtain the best results. They should also be the nucleus for your summer sales organizations, without which it is impossible to equalize your sales during the summer months. It is impossible to emphasize too strongly the importance of these Salesmen Demonstrators if you expect to be successful in developing the domestic market. They should be thoroughly conversant with all phases of the work, energetic and trustworthy, because these men are the point of contact with your market and the customer's service.

In the selection of salesmen for the summer's sales campaign the utmost care must be exercised. If you are to permit them to accept payment to cover part or all of their sales, they should be required to furnish a surety bond. If the Bonding Company is willing to accept the risk, it is apparent that your judgment as to character and honesty has been confirmed. When you interview your prospective salesman, it is well to mention that it will be necessary for him to furnish a surety bond. If his past will not bear investigation, he will not be anxious to accept a position as a coke salesman and it will save you considerable time and expense.

After the new salesman has had complete instructions in regard to the sale of coke, he should be sent out with one of the Salesman-Demonstrators until he is competent to go into the territory alone. Here again you must rely on the judgment of the Salesman-Demonstrator.

With the limited time at our disposal it was impossible for this Committee to do much more than call your attention to some of the pitfalls to be encountered in the development of a Domestic Coke Market.

If you have coke to sell, the Domestic Market, over a term of years, will probably yield as high, if not a higher, net return than the industrial market. Of course, Mr. Gas Man, you cannot expect to have a good domestic trade handed you on a silver platter, and if you and your gas customers are to enjoy the fruits of a well developed domestic market it is necessary for you to assume the role of a "Go Getter."

In justice to your gas customers it is your duty to get the best possible price for your coke on account of its intrinsic value and the consequent substantial credit to your manufacturing costs.

It originally had been the intention to have the Coke Committee prepare a text for a coke booklet to be published separately in quantity by the Association for distribution by gas companies desiring to develop a domestic coke market. Companies who have developed a profitable domestic market have found such booklets of great benefit in educating their public as to the value of coke as a fuel, how it should be burned, and in overcoming popular prejudices and misconceptions. As a part of the Committee work, however, this project was abandoned as it was felt that it would be difficult to prepare a text that would in all cases apply to the local situation, local trade names, etc., and because most of the large companies have either prepared their own booklets or are in a position to do so in quantities sufficient to secure full economies as to cost. However, there will be found in an appendix to this report following the Summary of Screen Sizes "The Firing Question," a text prepared personally by Mr. V. A. Miller, which can be used by member companies in preparing coke booklets of their own. The actual size of such booklets, quality of paper, etc., is a matter for local determination, but usually these booklets are made up for use with the No. 13 govern-

SUMMARY OF SCREEN SIZES

Company	Breeze	Pea	Small Nut	Nut	Stove	Egg	Furnace	Shape of Opening	Type of Screen	Material
A. S. T. M.	½″	¾″	——	1-¼″	1-¾″	2-½″	——	——	——	——
*Boston	——	¾″	——	1-½″	——	2-¾″	Over 2-¾	Round	Shaking	Plates
Chicago	½″		⅞″	1-⅝″	2″			Square	Rotary	
"c" Detroit	½″	¾″		1-½″		3″		Square	Curved Bars Vibrating	Wire
Providence	½″	¾″		1-⅛″	2″	2-½″		Square	Shaking	Wire
Rochester	⅝″		1-¼″	1-½″	2-¼″	Over		Round	Shaking	Plates
"a" St. Louis	⅜″	¾″		1-¼″	2″	2-½″		Square	Rotary	Plates
"b" St. Louis	½x1-¼			¾x1-½″	1-½x3		3x4″	Slots	Rotary	Plates
"d" Kalamazoo	½″	$\frac{9}{16}$x$\frac{13}{16}$″		1-¾″		Over			See Note "d"	
Terre Haute	½″	⅞″		1-½″	2″	3-½″		Square	Rotary	Plates

* Changing from shaking to rotary screens.
"a" By-Product plant of Laclede Gas Light Co.
"b" Retort House Coke of Laclede Gas Light Co. designated by numbers. Furnace Size—No. 2; Stove Size—No. 3 and Nut Size = No. 4.
"c" Egg and Chestnut sizes through curved bar screens. Pea size, hummer vibrating wire screens with an effective opening a half inch square.
"d" Breeze through ½″ round perforation; pea, $\frac{9}{16}$″ x $\frac{13}{16}$″ slotted plate; stove, through 1-¾″ revolving disk grizzly; and furnace size over grizzly.

ment or No. 7 regular envelope (3¾" x 6¾") and cost in lots of 10,000 from 1c to 4.07c per copy. An attractive cover design is desirable and for the text given in the appendix the cover plans contemplated a large bright red question mark over a pile of incandescent coke with title of booklet in black lettering above the question mark; the back cover to have an attractive black and white sketch of a cozy home heated with domestic coke.

THE FIRING QUESTION

V. A. Miller, *Chairman,* Coke Committee, Rochester, N. Y.

"The Firing Question" has been prepared by Mr. V. A. Miller, Chairman of the Coke Committee to serve as a guide to member gas companies in preparing Coke Booklets for distribution among their prospective coke customers. Companies who have developed a profitable domestic market for their coke have found such booklets of great benefit in educating their public as to the value of coke as a fuel, how it should be burned, and in overcoming popular prejudices and misconceptions. The size of the booklet, quality of paper, etc., is a matter for local determination but usually these are made up for use with the No. 13 government or No. 7 regular envelope (3 3/4 x 6 3/4) and cost in lots of 10,000 from 1c to 4.7c per copy. An attractive cover design is desirable and for the text given herewith the cover plans contemplated a large bright red question mark over a pile of incandescent coke, with title in black lettering above the question mark, the back cover to have an attractive black and white sketch of a cozy home heated with domestic coke.

As the larger companies have either prepared their booklets or are in a position to do so in quantities sufficient to obtain full economies, it was decided to publish the above text as an appendix to the Committee's report and not in separate form as a booklet for distribution. However, if member companies feel that they could use this text, prepared in the form of a booklet with cover design and size as described, in sufficient quantity to afford an economy in its printing the Association will be glad to consider its publication as a booklet. If you are interested, please advise the Secretary-Manager how many copies of the booklet you can order for use in your local situation. Such advice should reach Association Headquarters not later than August 20, 1923. (Editor's Note.)

To you and to hundreds of other progressive householders, the steadily rising cost of living has been, and is, a big problem—every householder is looking for methods and ideas to save time and money.

Possibly one of the heaviest forms of expense in the home is *fuel expense*—this can be reduced materially by using a fuel that isn't "just as good" but is *better* than coal.

We are living in an age of conservation —the time is fast approaching when coal will be the fuel of the past, for soft coal wastes too much in smoke, soot and unburned gases and *waste* makes cost.

Nature has, through pressure during countless ages, transformed soft coal into anthracite, or hard coal, by removing those substances from which tar, oil, gas, etc., are produced.

In the manufacture of "DOMESTIC" COKE *heat* is used instead of pressure to drive off the tar, gas, etc., etc. "DOMESTIC" COKE is manufactured in air-tight ovens, heated externally in much the same manner as bread is baked in an oven. The soft coal is actually baked—none of it being burned in the process.

"DOMESTIC" COKE—the fuel of quality, contains 85 to 90 per cent carbon.

Carbon—the heat producer—is the most important and valuable part of domestic fuel, for most household boilers, furnaces, and stoves, are not constructed to fully utilize the gas which escapes when coal is heated or partially burned.

The same price is charged for that part of the fuel which is ash, as for the carbon or *heat* element part.

"DOMESTIC" COKE is capable of producing intense heat under high or forced draft, and is equally adapted under a regulated or checked draft to produce a slow, even heat.

"DOMESTIC" COKE is liked by women because it is light to handle and does away with constant cleaning, for it leaves very little ash, only about one-half the quantity that comes from hard coal. "DOMESTIC" COKE burns to a fine ash—none to sift.

"DOMESTIC" COKE ignites quickly and responds to a change in draft in very much less time than hard coal. A fire that can be kindled quickly adds much to the comfort of the consumer, for the house can be warmed in the morning in less than half the time required with anthracite coal.

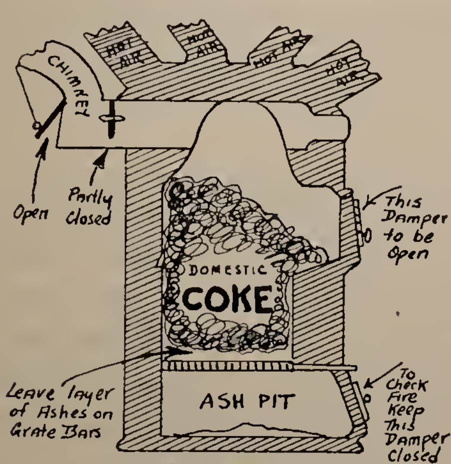
You may know what it means to get up in the morning and stand around cold and shivering while waiting for a hard coal fire to get started.

"DOMESTIC" COKE is a splendid fuel for the kitchen range. A hot fire can be obtained in a few minutes after lighting. As soon as the fire burns up through the fuel — by regulating the drafts, you can get any heat you want.

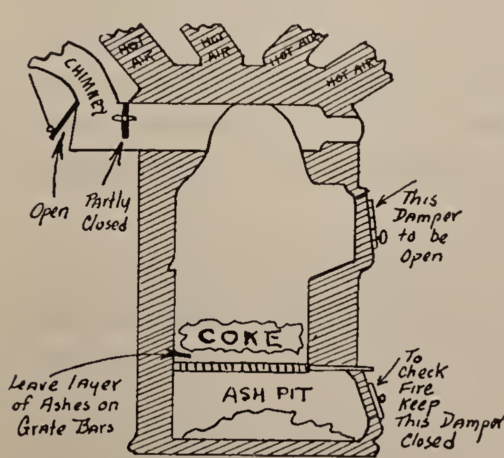
THE WAY TO BURN IT

To Start the Fire

Build the fire in the usual way—leaving drafts open until fire is well started.



THE RIGHT WAY
THE SECRET - A SMALL AMOUNT OF DRAFT UNDER A BIG BODY OF FIRE



THE WRONG WAY

Then *fill the fire pot full* of "DOMESTIC" COKE, leaving drafts on for a few minutes, after which *close* all drafts.

During the Day

Keep a fairly large bed of fire under a checked draft. Under ordinary circumstances it will require no more attention.

It is much more economical to have a large bed of coke under a low draft than a small fire under a strong draft.

At Night

Have a bright bed of fire in the fire pot. Fill up fire pot *full* with "DOMESTIC" COKE. Open all drafts for a few minutes until the fresh coke is well heated —then regulate all drafts to suit weather conditions.

In the Morning

Do not rake or shake the fire—poke a few holes from above. Throw on a couple shovelfuls of "DOMESTIC" COKE and *open all drafts* and fire will pick up in about ten minutes.

Then fill the fire pot *full* and *close* all drafts.

Care of Grates

"DOMESTIC" COKE *does not injure grates or fire pot.*

Nothing is further from the facts, as the conditions in a furnace or stove are not right to melt the grates or fire pot with any fuel, whether it be coke, hard or soft coal, wood or charcoal, unless your heating appliance is subject to very severe abuse.

Always have a layer of ashes—two or three inches thick on top of grate—this checks the drafts and gives the best heating results.

Remove ashes from the ash pit at least once a day—an accumulation of ashes in fire pit causes damage to grates, as this prevents cold air from coming in contact with the grate.

Bear in mind always—"DOMESTIC" COKE *requires less draft than hard coal.*

Whether you operate a hot-air furnace, steam or hot water heater, the principle of burning "DOMESTIC" COKE is just the same.

The strongest testimonial any fuel can have is its continued and increasing consumption.

Our customers have given "DOMESTIC" COKE this endorsement.

ORDER BY SIZES

Sizes are the same as hard coal:

Nut size—for Kitchen Ranges, Small Heating and Laundry Stoves.

Stove size—for Medium size Furnaces, Steam or Hot-water Heaters.

Egg size—for large size Furnaces, Steam or Hot-water Heaters.

We recommend "DOMESTIC" COKE for your use—a trial will convince you that it is the modern fuel for the household, the ideal fuel for heating and cooking.

If "DOMESTIC" COKE is not all we claim tell us promptly.

It does not pay to experiment with inferior cokes, and therefore, you cannot afford to take a chance, so order from us.

Why Coke Should be Burned

Coke should be used for heating houses because it is a clean and convenient fuel. It eliminates smoke, reduces the necessity of cleaning the furnace and flues, requires less attention than coal, and gives a more uniform temperature in the house.

W. H. Blauvelt (Terre Haute, Ind.): There was one statement in the Coke Report that is a little misleading. It speaks of the heavy load on the transportation system of the country, and it says:

"They"—the railroads—"as you know, have the nation's fuel supply to transport at a time when the nation's production of manufactured goods requires transportation in addition to crop movement."

As a matter of fact, the extra seasonal demand on the railroads for fuel consumption does not amount to an increase of over 15 per cent, but in some cases it is just the straw that breaks the camel's back. This leaves this in exaggerated form and I thought it was worth while to call attention to that.

It also serves to emphasize the point which the committee wishes to make, namely, the importance of getting a uniform demand throughout the year, because it does not take such a tremendous shift from the average demand to break the camel's back. There is one more statement here which is very mild:

"Now as an inducement to overcome the inertia of the fuel-buying public, why not give them all or at least part of the saving effected due to the better load factor on your equipment?"

I think that the majority of manufacturers of coke in any considerable extent, and certainly the majority of coal operators, are very glad to give to the consumer a good deal more than the direct savings that come from a better, more even distribution of fuel during the year. The difficulty is that the saving to the producer is not in itself generally sufficient to get the consumer to lay in his winter's supply on time.

As a producer of domestic coke in the middle west, the very small percentage of egg coke that is quoted as being sold, seems very curious. One case where 8,000 tons a year are sold, the egg is quoted as 2.3%; with 78.5% stove; a New England case with 20% egg and 50% stove. Now in the middle west the proportions run about 60% egg, and in one case they were about 75% egg; stove generally runs about 15 or 20%, nut 15 or 16%, and pea about 3 and 5%. So the percentages given here evidently vary greatly with the different parts of the country. Therefore, the problem of coke sizing and the demand for specific sizes seems to be like the tariff, very largely a local problem.

S. S. Wyer (Columbus, Ohio): In connection with some educational work that has been directed by the Smithsonian Institution in Washington, there has been prepared a small 16-page manual known as the "Fuel Manual for the Home." The Smithsonian Institution has sent this to practically every newspaper in the United States with a newspaper story. A number of newspapers are taking, either in whole or in part, material from this and running it as syndicate material. Arrangements have been made so that anyone who wishes to have additional copies can have the use of the plates by merely paying for the net cost of reprinting.

Just to give you one specific application as to how the public should be most vitally interested in this—in the introduction there is this statement:

"Anthracite, although a natural monopoly from a geographical viewpoint, is not a monopoly from the point of use,

since man-made anthracite—that is coke —can easily be made to take its place, and building up the demand for substitute fuel is one form of insurance against combinations of labor or of capital and the consequent raising of prices."

One member of the Coal Commission made the statement that if the idea in that paragraph could be sold to the anthracite-using public, it would mean a saving of anywhere from one to two million dollars to that anthracite-using public, because both the anthracite miner and the anthracite operator are today obsessed with the idea that they have a monopoly and that there is not a competitor for their anthracite, whereas your coke is a direct competitor. Merely changing the mental attitude of those two groups when they approach the readjustment of their wage and price problem at the next April conference would accomplish the saving estimated.

One large trust estate—I will not mention it by name—has raised the royalty from ten cents a ton on anthracite to $1.27 a ton without one red cent increase in cost, and passed that all on to the public, and have done that in the last four and one-half years.

As the situation stands today, the coke industry and the gas industry have a splendid opportunity of getting their coke information out to the public and getting it out in a way that it will be taken at practically its face value without discount. The government activity that has crystallized in the preparation of this manual has prepared the way, so that if the industry will merely follow, you can develop a very large business, not only in the sale of coke, but in the further sale of goods for incidental house-heating purposes.

R. L. Fletcher (Providence, R. I.): The size of the crowd that left the room the minute coke was mentioned, illustrates to me better than anything else the attitude of the gas man. He is still just a gas man and until he comes to realize that he is a gas and a coke man, it is an uphill battle to put coke where it is going to be eventually.

The interest taken in house-heating by gas was evident. It is further evidenced in the exhibition hall by the several models of house-heating boilers equipped for gas. But you do not see any exhibit specializing on coke, although it has been mentioned that several manufacturers are making a special oven.

We have no slogan applicable to coke, equivalent to the slogan adopted by the American Gas Association for gas: "You can do it better with gas." Undoubtedly that slogan has done a great deal for the industry since it was adopted. The Association should adopt a national slogan applicable to coke which will put over the idea as well as the slogan for gas has been put over.

An outsider might receive the impression, from the report just read, that gas companies have considerable trouble selling their coke. We all know that we can sell coke and do, but I believe firmly that no gas company is selling coke for what it is worth. Figure out what it is actually worth and you will have to admit that we are far from that price.

I have found that the average gas man from the small plant feels that our reports and papers do not apply to him at all. He will say: "Well, you fellows, that make so many thousands of tons a year, can do that, but we can't. That doesn't apply to us at all." It applies to him more than it does to the other

fellow, because the fellow making a lot of coke is after these things every minute, and the small fellow is sitting back and saying: "I can't do much along this line because I don't make enough." He needs a talking to.

The coke business of the gas company reflects on the gas company in the same way that good or poor gas service reflects on the gas company. We are too prone to feel that the public considers coke as a separate issue from the gas company. They do not. They think that coke is part of the gas business, and if complaints come in on coke it reflects on the gas company as a gas company.

Coke should not be considered as a by-product but as a main product of equal importance with gas. Coke is no residue, nor is it in any way a substitute for anthracite or bituminous coal. It should be considered and spoken of by you and your employees as a better and cleaner fuel.

Companies large and small should from time to time make campaigns for the sale of coke as well as carefully consider and investigate the employee's use of coke in his own home. We have spoken of this before, but I do not think that the story has gone through. We feel quite proud in our company that we have a very large employee use of coke, but I would like to extend that even further. We should sell the idea of coke to the employee so soundly that he will in turn sell it to his immediate relatives.

Last year I emphasized more strongly the fact that we must sell our neighboring gas companies the idea of coke and its value. In the east the water gas man who has no coal gas plant is using anthracite coal and there is no greater slap in a tender spot than that to the gas man. If you cannot sell the plant superintendents the idea of coke, how are you going to sell it to the public?

I have been told many times by the average citizen in Providence that the gas company must be making an enormous profit on coke and probably the average employee of the company feels the same way. The employee and the public ought to be shown that, whatever the price of coke, it is in return a benefit to the community at large.

If I were a member of a public utilities commission where a gas plant was selling coke for a very low price, I would get after them pretty strongly. If they came to me for a raise in the price of gas I would tell them nothing doing until they prepared, screened and sold their coke at what it was worth. That may be a hard statement, but all this talk we have here on the value of coke goes in and sometimes stays, but I am afraid we are pretty near where we were before.

Our Association should undertake national advertising of coke either by voluntary contributions from the various companies producing coke, or otherwise. A national advertising campaign for coke has a distinctly different flavor to the average citizen, coming as a national ad rather than a community ad from his local gas company. I also appreciate the trouble in doing that, is that some of us should not have our coke nationally advertised, "As clean as the sun's heat" or "Best fuel on earth," etc., until he gets his house a little cleaner and puts out that kind of fuel.

If you are sold on coke each one of you sell to the gas men you meet here and elsewhere the idea that coke is just as much of an issue to him and to us and the industry as his product—gas.

N. H. Memory (Newark, N. J.): One of the objections to coke from the users' standpoint is that it is necessary to use six shovels full of coke instead of four shovels full of coal. Has it ever been found practicable to attempt mixing some of the smaller sizes of coke in with the larger, with the idea of reducing the storage space and filling up some of the holes, and also getting a little more coke in a different size firebox?

V. A. Miller (Rochester, N. Y.): It is up to the individual to determine whether he wants to have coke in smaller sizes or not. In Rochester we cannot get enough of the nut, and if you do not have small sizes for sale you do not want to sell them.

Mr. Fletcher says that we ought to have a slogan. That will probably help some in selling coke but you have to work like the devil if you want to sell it, do not forget it. You cannot sit down and think it is coming to you. Certainly if you sell coke you do not want all your business in the winter when everybody wants it. You can kid yourself along and say that you will make further reductions, etc., but the customer is pretty well satisfied if you give him what you save, and in some cases they have taken all the coke that you would want to sell. I know one concern last year that stopped selling in July, and this year they stopped selling in May, practically the beginning of the sale season. So it is up to each individual whether you want to go after it or whether you want to wait for it to come to you.

J. D. MacArthur (Jersey City, N. J.): It was stated that a number of gas companies were selling their coke at too low a price. Well, at Seaboard during the war, we could not get good coal, and in consequence could not make such good coke. Since then we have always made it a point to get the best coal, and to use as near as possible the same coal day after day so that the customer will get a uniform grade of coke. The ash and sulphur should be as low as possible; the fusion temperature very high.

Under such conditions the public quickly appreciates that a certain coke is good, and they will grab it very fast. We have had practically all the coke we could produce sold since the first of April, until the first of April of next year. We have no trouble whatever in getting all of the gas companies that are in the vicinity of Seaboard to use coke. There are probably ten or fifteen gas companies using our coke and six or eight more on the waiting list as soon as coke is available.

In the sale of domestic coke, the average furnace in the house is not in any condition to burn coke. Coke needs but half the draft of the hard coal. In the average house furnace there are cracks possibly a quarter of an inch wide in the under side of the grates, allowing air to go up through. If we could get furnace-makers to make doors with joints so that when you shut the air off you actually shut it off, then we could say to every customer without hesitation that his fire would hold an indefinite period.

I find that the average gas company goes into the matter of deliveries without giving very much thought to it. As a rule, the truck drives up; they take it in; they spill coke all over the lawn; when they get it into the cellar they spill it all over the celler. They make no provision down at the bottom of the coke bin, for instance, to shovel it out easily and put it in. They do not stay with the customer long enough to teach him just how to use coke. We find that 95 per cent of the people that begin to

use coke, continue and they repeat one time after another.

We also find that the average householder knows less about his furnace than he knows about his automobile. His furnace is a kind of a dirty object to handle and he does not care to do it. The average furnace is so clogged up with soot or some other material that probably its efficiency is not 40 to 55 per cent, as has been stated here this afternoon, but 20 per cent.

We have made many comparative tests with coke, using the same apparatus as had been used with anthracite coal, and without any trouble have shown coke to be 15 to 50 per cent better. Of course, you know well enough that that is not altogether so, because with furnaces in good shape they would get pretty good results from anthracite coal.

When going into a home we see that the furnaces are well cleaned out and regulated, first of all, and then we have no trouble at all in convincing the householder that coke is just what he wants to use.

Size of coke varies with localities. In New York 95 per cent of the coke sold is egg size because all of the buildings are large and the furnaces comparatively larger. In Newark, Jersey City, Montclair, etc., the average homes are smaller and stove size is the general rule. We also sell nut size for kitchen ranges, and pea size we prefer to use in producers, etc., unless there is a special purpose for which it is to be used.

We send out return postal cards on every delivery that is made so that the customer will write back just what his impression is on coke, how the deliveries are made, and what satisfaction he is getting.

The first three years it is well to spend a larger proportion of money than ordinarily in sending men out to demonstrate, follow up and take care of every little trouble that arises. In that way you get a very good class of satisfied customers.

F. J. Ikena (Baltimore, Md.): Does Mr. MacArthur use a different mixture of coals for water gas coke than he does for domestic coke and what are the sizes of coal mixtures that he uses?

J. D. MacArthur (Jersey City, N. J.): We use the same mixture of high and low volatile coal all the year around, about 66⅔ per cent of high volatile coal and 33⅓ per cent of low volatile coal and running on about 18 hours coking time.

ADJOURNMENT.

THIRD SESSION

Thursday Afternoon, October 18, 1923.

REPORT OF THE COMMITTEE ON FUNDAMENTALS OF CONDENSING AND SCRUBBING

W. H. Earle, *Chairman*, Rochester, N. Y.

Your committee was appointed this year to replace the 1922 committee on Gas Plant and Production. Its scope, within the field of Gas Manufacture, was designated as that included between the hydraulic main of the coal carbonizing plant, or the wash box of the water gas machine, and the inlet of the purifiers.

Obviously this opens up a tremendous range for committee activities. It includes all phases of operation pertaining to condensers, exhausters, ammonia scrubbers, tar extractors, ammonia concentrators, ammonium sulphate equipment, and other apparatus in the usual sequence, together with all auxiliaries pertaining thereto.

For the present year it has been the purpose of this committee to confine its efforts to the inital stage within its assigned field, viz. primary condensation, in the hope that it can initiate a systematic study of the field to be progressively developed by future committees.

The attention of the committee has been emphatically called to the apparent fact that, in the study of the operation of existing condensing systems, and in the planning of new systems, there is a regrettable lack of knowledge and understanding of the prime factor. This factor appears in the fundamental question.

What is the saturation temperature of the gas at the inlet of the condenser?

The meat of the problem is in the word "Saturation."

By saturation temperature is meant, the temperature at which the gas is saturated with whatever quantity of water vapor it carries. (Condensible tar vapors are included as water until such time as research develops a significant difference between them.)

A leader in the industry writes, "In my own calculations on the sizes of condensers, the amount of cooling water to be used, etc., I have disregarded entirely the sensible heat of the gas and have considered only the latent heat of vaporization which so greatly exceeds the former as to make it practically negligible.

The importance of this term cannot be too strongly emphasized. It is the key to the entire problem of primary condensation. The heat to be removed

from a 1,000 cubic feet of dry gas is insignificant in comparison with that to be removed from the same volume of gas if the gas is saturated with water vapor. Furthermore, the heat to be removed from the gas in cooling it to any desired temperature is insignificant in comparison with that to be removed in perature of the gas, but not to the same extent as the cooling surface. The assumptions are based on the most economical use of cooling water.

Table (2) was compiled for the client of a builder of condensing systems to illustrate and emphasize the significance

TABLE 1

Compiled by the Isbell-Porter Co.

THEORETICAL CONDENSATION

Table Showing Effect of Cooling 550 B.t.u. Water Gas
Based on 1000 C. F. of Saturated Gas at 60° F. & 30″ Bar,

Temp. F.	Vol. of Orig. M.C.F. Gas with Vapor Cubic Feet	Cont'n Due to Loss of W. Vapor Cu. Ft.	Cont'n of Gas Due to Cool. Cu. Ft.	Vapor in Expanded Humid Gas Lbs.	Sensible Heat in Dry Gas B.t.u.	Heat in Water Vapor B.t.u. *Latent*	*Sensible*	Total Heat in Gas and Water Vapor B.t.u.'s.
200	5710	4440	270	169.9	2863	166,157	28514	197,534
190	3390	2140	250	82.9	2660	81,518	13059	97,237
180	2470	1240	230	49.2	2455	48,754	7266	58,475
170	2050	840	210	33.1	2249	32,948	4540	39,737
160	1735	544	191	22.5	2045	22,521	2852	27,418
150	1550	377	173	16.0	1840	16,113	1865	19,818
140	1430	277	153	11.6	1615	11,793	1235	14,643
130	1285	150	135	8.2	1431	8,339	778	10,548
120	1245	130	115	6.1	1227	6,275	515	8,017
110	1200	105	95	4.5	1022	4,647	329	5,998
100	1138	61	77	3.24	818	3,359	197	4,374
95	1110	42	68	2.74	715	2,847	150	3,712
90	1093	35	58	2.33	613	2,424	112	3,149
85	1075	27	48	1.94	511	2,054	81	2,646
80	1059	20	39	1.66	409	1,740	57	2,206
75	1047	18	29	1.41	306	1,483	38	1,827
70	1030	11	19	1.18	204	1,246	21	1,471
65	1015	7	8	.99	102	1,049	10	1,161
60	1000	—	—	.83	—	878	—	878

Notes:
1. Heat removed from tar and oils not included above.
2. Heat in gas due to water vapor is subject to correction from conditions other than saturaton.
3. Sensible heat of vapor removed in drip; balance by cooling water and radiation, etc.

condensing the great bulk of tar and water vapors.

The figures in Table (2) showing the cost of the cooling surface are based on cooling gas at the rate of 10 million cubic feet of gas per 24 hours. These figures do not take into consideration the cost of the condenser shells, grids, pumps, piping, etc., which are affected by the saturation temperature. While the figures apply to a large plant, they are relatively true for a plant of any given size. So far as costs are concerned the table must be regarded as illustrative and not as a basis for cost estimates.

To graphically present the data contained in tables (1) and (2), the following curves are called to your attention.

Curve (1) Volume of 1000 cubic feet of dry gas when saturated at different temperatures.

Curve (2) Contraction of gas due to loss of water vapor in cubic feet.

Curve (3) Contraction of gas due to cooling only, in cubic feet.

TABLE 2

Compiled by The Steere Engineering Co.

Temperature of Gas Saturated with Water Vapor at the Inlet of Condenser	Temperature of Gas at Outlet of Condenser	Temperature of Water Used for Cooling	Cost of Cooling Surface
180° F.	90° F.	85° F.	$22,000
175	90	85	19,200
170	90	85	16,600
180	100	85	17,000
175	100	85	14,700
180	100	80	16,000
175	100	80	12,600

Curve (4) The sum of curves (2) and (3). Total contraction of gas due to cooling and loss of condensible vapors.

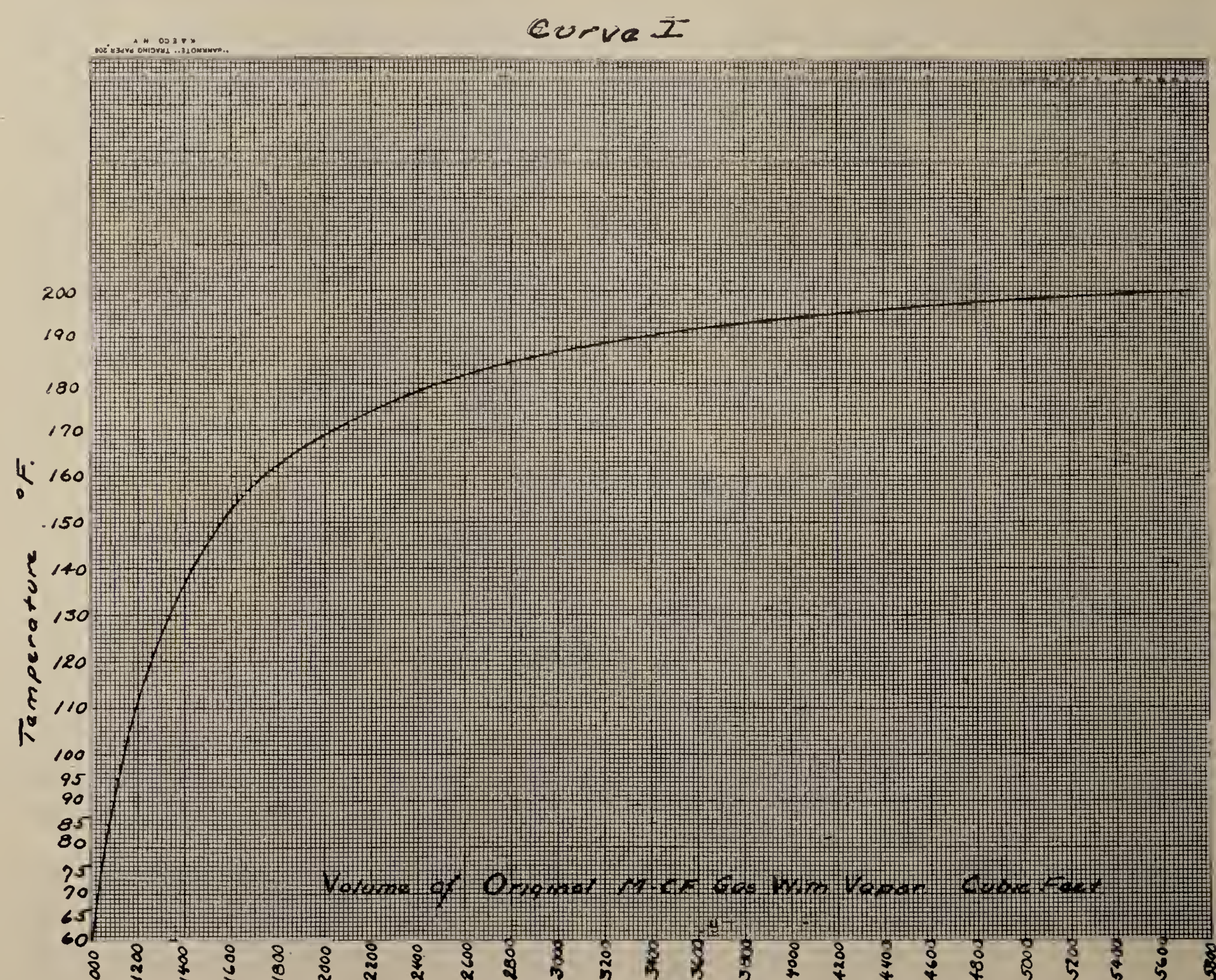
Curve (5) Quantity of vapor, in pounds, in saturated gas per 1000 cubic feet.

Curve (6) Sensible heat in dry gas, in B.t.u.'s per M. cu. ft.

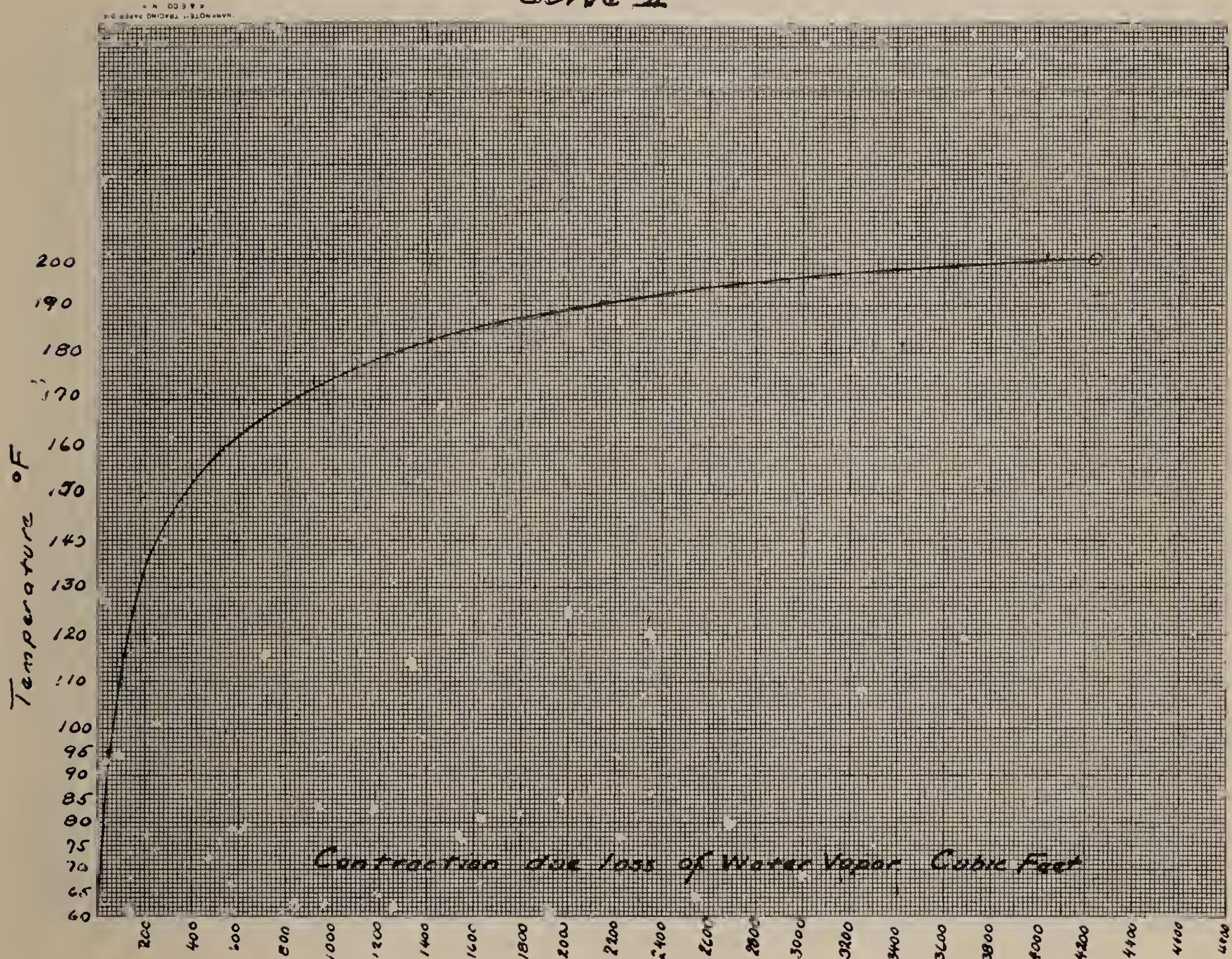
Curve (7) Latent heat in water vapor of saturated gas in B.t.u.'s per M. cu. ft.

Curve (8) Sensible heat in water vapor in saturated gas in B.t.u.'s per M. cu. ft.

Curve (9) The sum of curves (6) (7) (8). The total heat in 1000 cu. ft. of saturated gas.

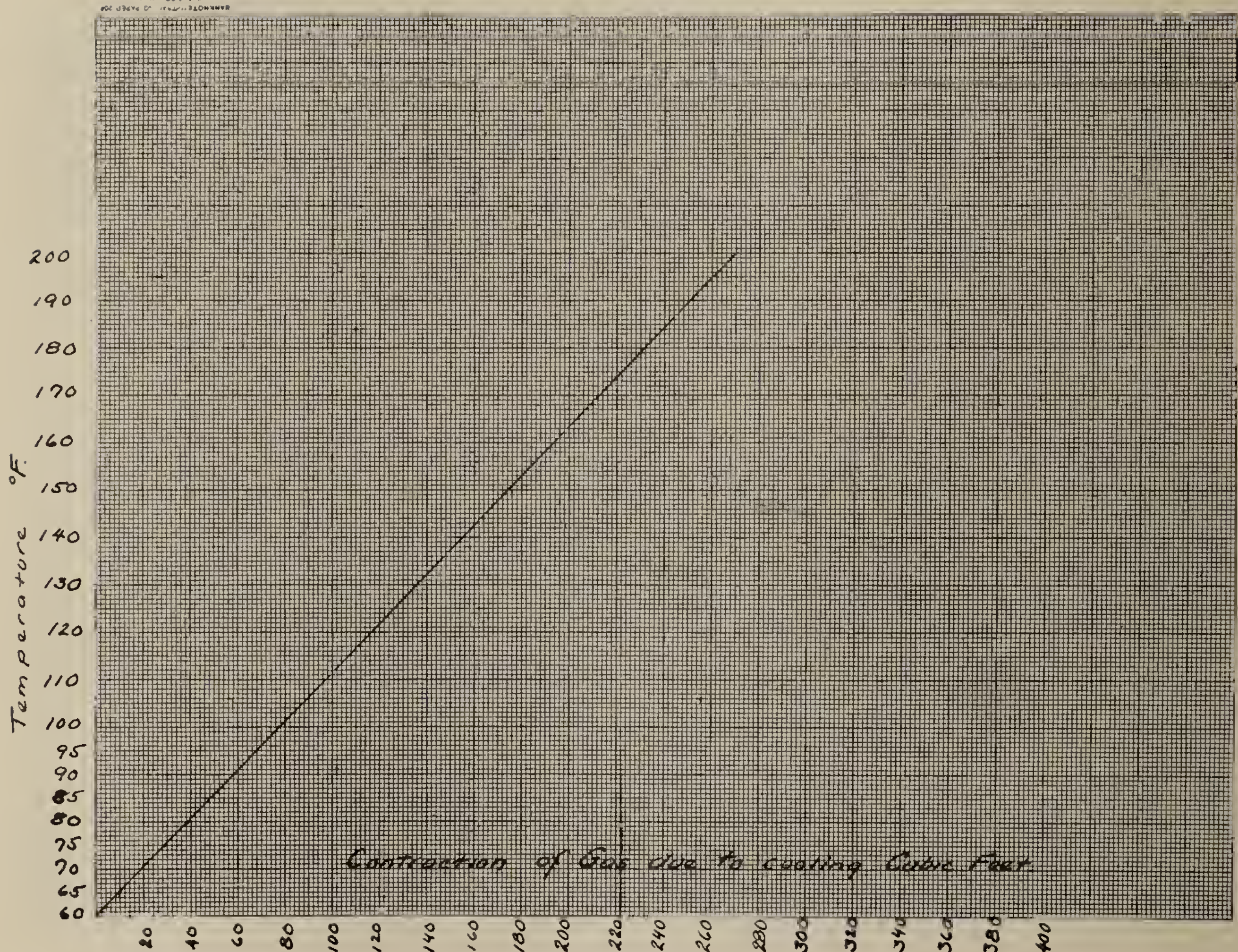


Curve II



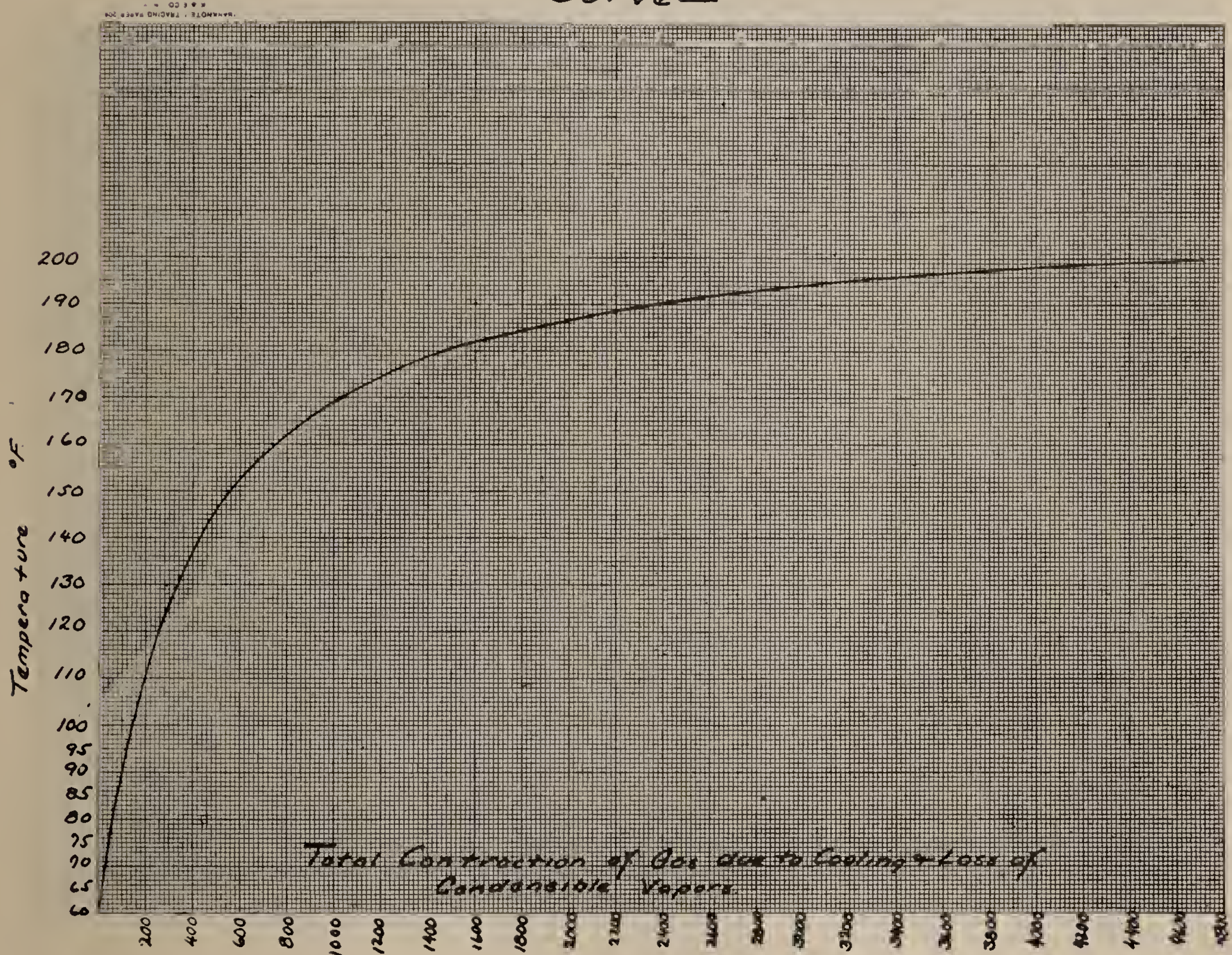
Temperature °F
200
190
180
170
160
150
140
130
120
110
100
95
90
85
80
75
70
65
60
Contraction due loss of Water Vapor Cubic Feet
200
400
800
1000
1200
1400
1800
2000
2200
2400
2800
3000
3200
3400
3800
4000
4200
4400

Curve III

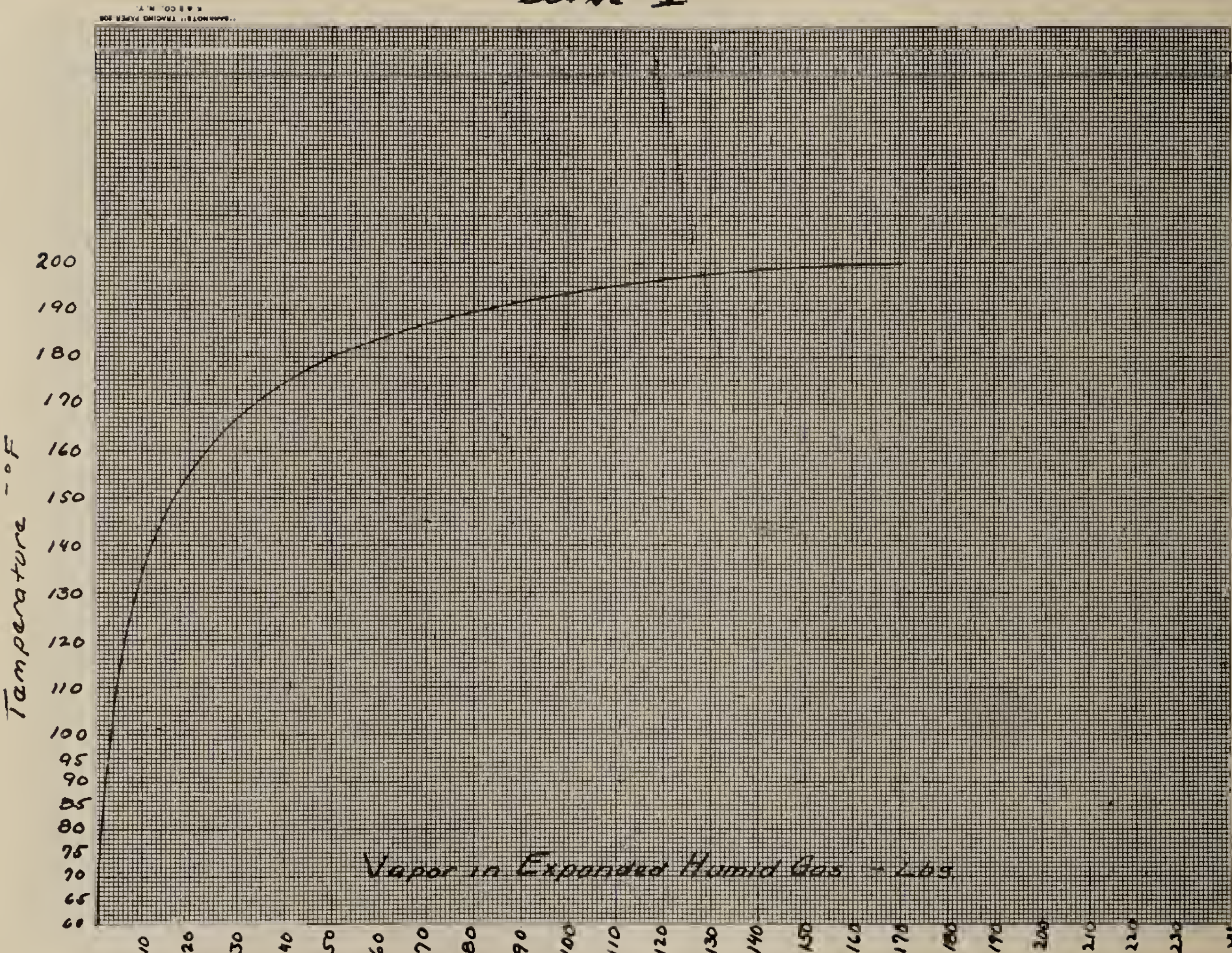


Temperature °F.
200
190
180
170
160
150
140
130
120
110
100
95
90
85
80
75
70
65
60
Contraction of Gas due to cooling Cubic Feet
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400

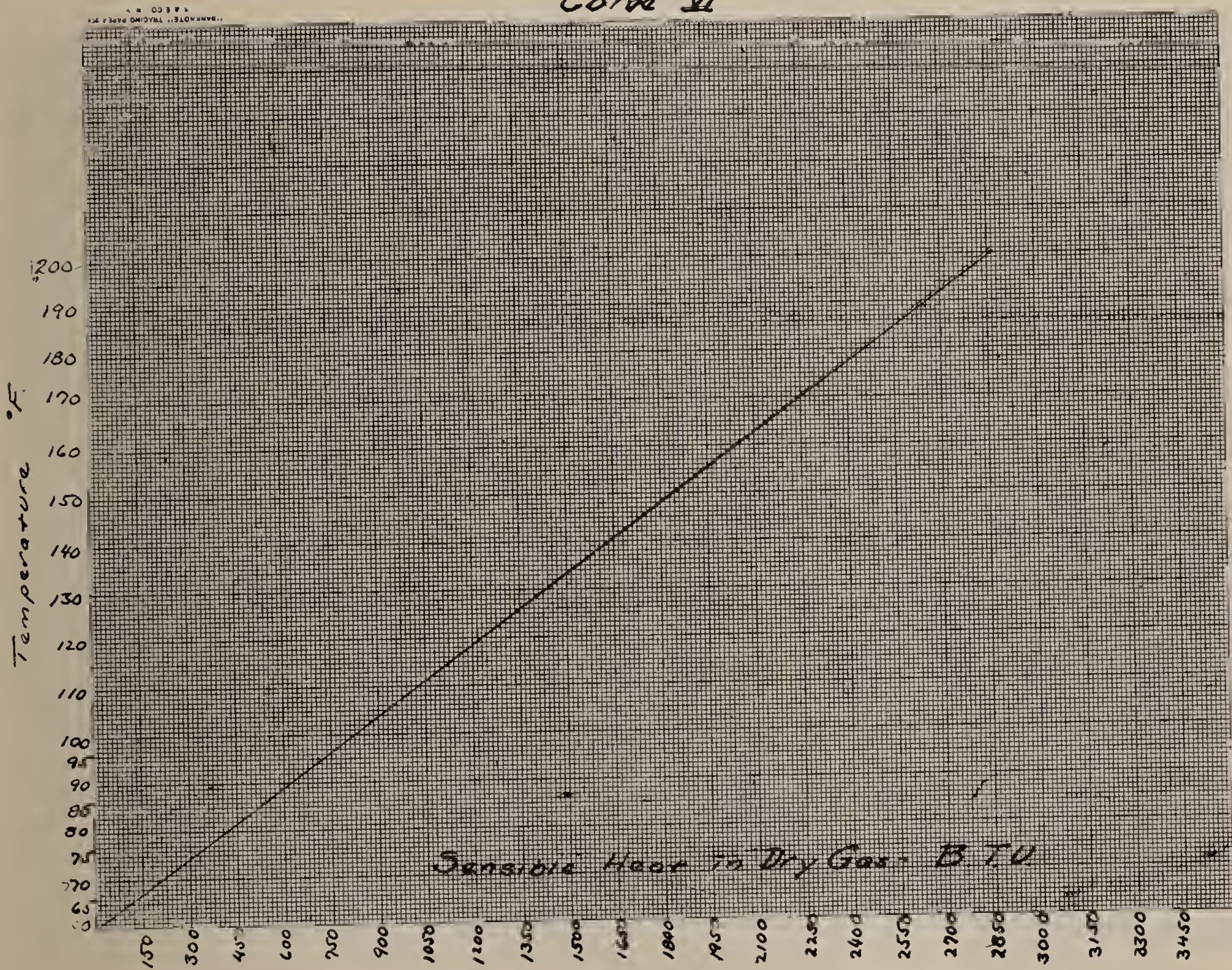
Curve IV


Temperature °F
200
190
180
170
160
150
140
130
120
110
100
95
90
85
80
75
70
65
60
200
400
600
800
1000
1200
1400
1600
1800
Total Contraction of Gas due to Cooling + Loss of Condensable Vapors.

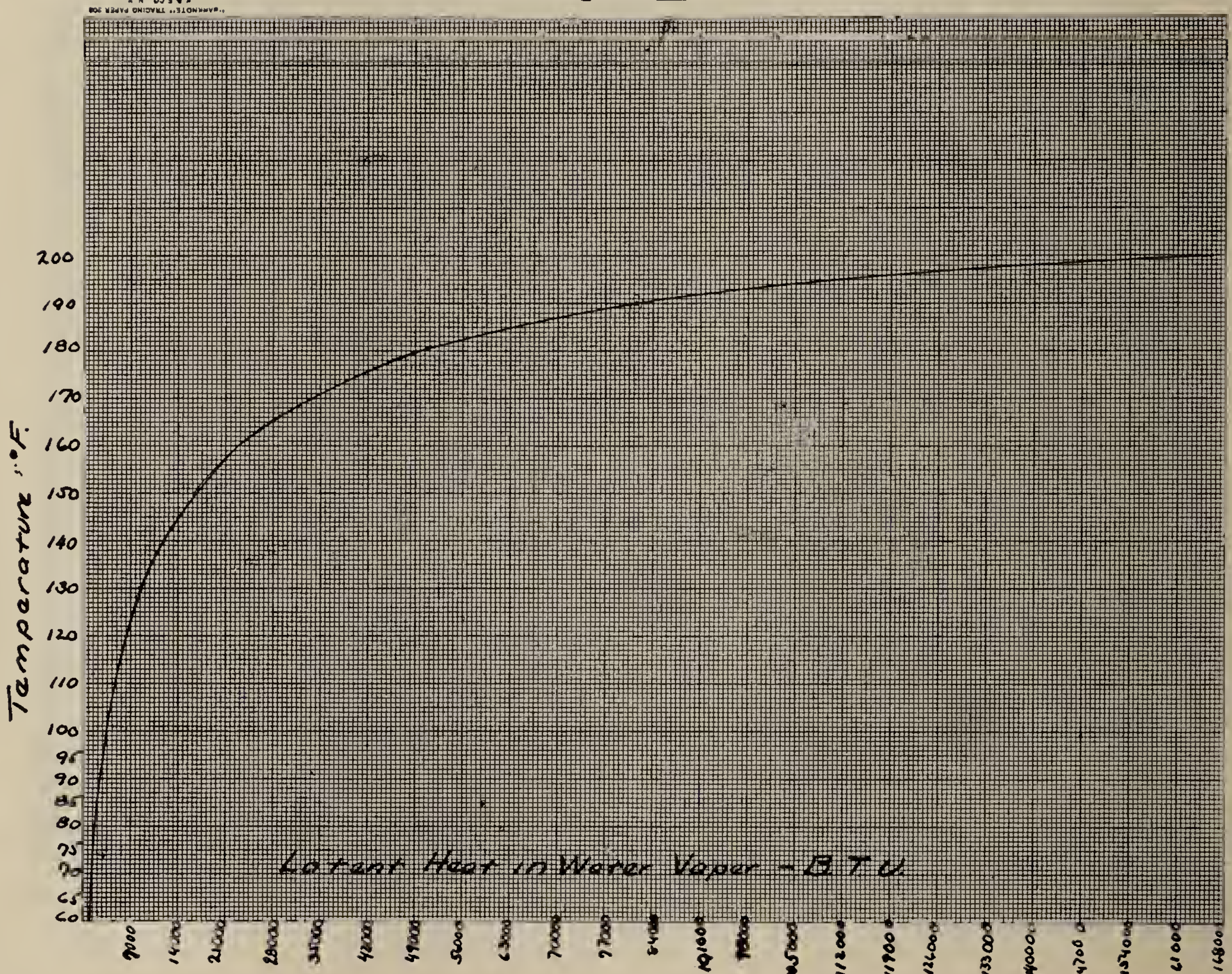
Curve V


Temperature - °F
200
190
180
170
160
150
140
130
120
110
100
95
90
85
80
75
70
65
60
Vapor in Expanded Humid Gas - Lbs.
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230

Curve VI

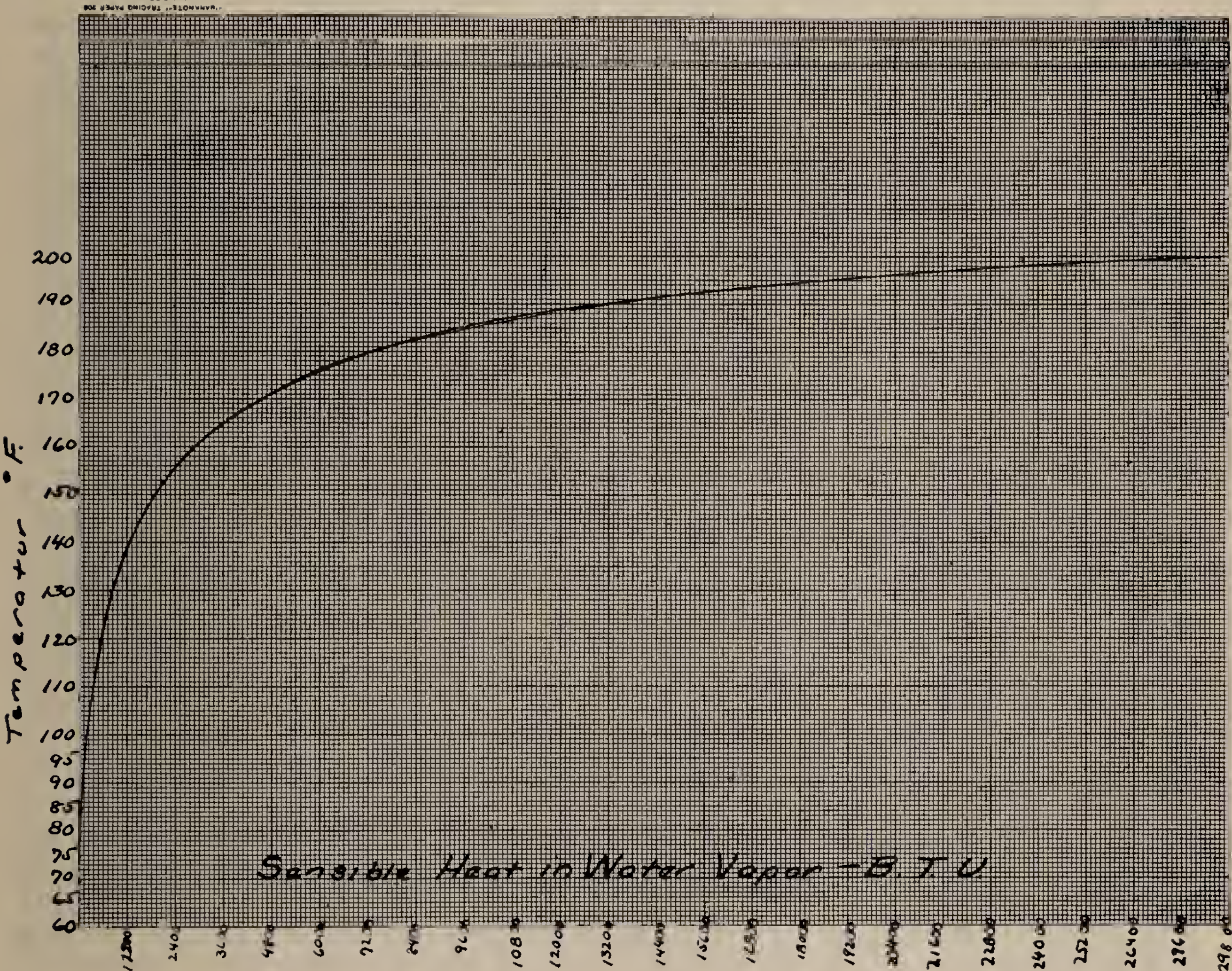

Temperature °F.
200
190
180
170
160
150
140
130
120
110
100
95
90
85
80
75
70
65
Sensible Heat in Dry Gas - B.T.U.
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
1950
2100
2250
2400
2550
2700
2850
3000
3150
3300
3450

Curve VII



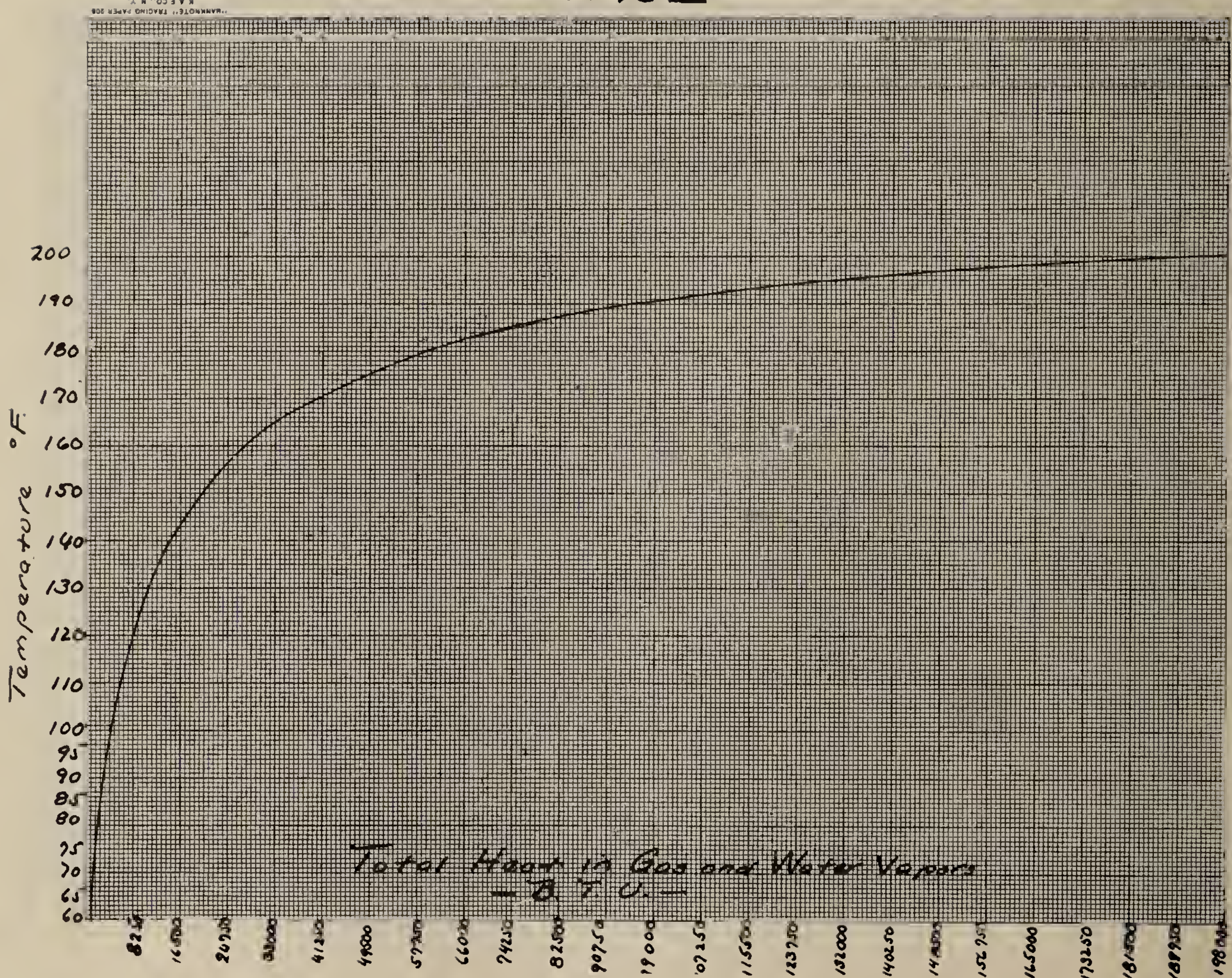
Latent Heat in Water Vapor - B.T.U.
200
190
180
170
160
150
140
130
120
110
100
90
80

Curve VIII



Temperatur °F.
200
190
180
170
160
140
120
110
100
95
90
80
70
60
Sensible Heat in Water Vapor – B. T. U.

Curve IX


Temperature °F
200
190
180
170
160
150
140
130
120
110
100
95
90
85
80
75
70
65
60
66000
74250
82500
90750
115500
123750
132000
140250
165000
173250
Total Heat in Gas and Water Vapors
— B. T. U. —

We believe that such data as is contained in Table (1) has many applications, perhaps not fully realized at first glance. For instance, it bears on sizes of pipe lines, sizes of sumps and separators, capacities of exhausters, quantities of cooling water needed, suitable and economical locations of condensing apparatus, relation of relief holders to relative location of condensers, pressure conditions, etc.

However, within the limits of the plans of the committee it emphasizes the importance of having a knowledge of the saturation temperature to be met in any specific instance. Suppose you are planning a condensing system for a one million cubic foot coal gas plant. Assume that the primary condenser is to be built to cool the gas to 100° F. If you take 190° F. as the inlet temperature, and assume the gas is saturated at that temperature, you will note that 92,863 B.t.u.'s must be removed from every 1000 cubic feet. If however, the gas is saturated at 180° F. instead of 190° F. there are only 54,101 B.t.u.'s per 1000 cubic feet to be removed. That is, the amount of work to be performed is reduced more than 40%. Furthermore, if 170° F. is the actual saturation temperature, the heat to be removed is only 35,363 B.t.u.'s per 1000 cubic feet, or a reduction of more than 60% below the original assumption. It is perfectly apparent that this must have an influence of great importance on investment and on operating conditions and costs.

The importance of Table (2) obviously lies in the significant relationship between the saturation temperature and the tangible item of investment costs. For instance, on a ten million cubic foot plant.

(1) If the saturation temperature is 175° instead of 180° an investment cost of $2,800 is saved, whereas, if it is 170° instead of 180° an investment cost of $4,400 can be saved.

(2) If the outlet temperature can be allowed to stand at 100° instead of 90°, a saving of approximately $5,000 can be affected.

(3) If the cooling water temperature is 80° instead of 85° a still further economy of from $6,000 to $9,400 is possible.

Before leaving this table your attention is called to other items which bear close watching.

(1) The outlet temperature desired. Note the difference in cooling surface in terms of dollars between a required outlet temperature of 90° and 100°.

(2) The temperature of the cooling water.

In northern latitudes where water temperatures and atmospheric temperatures vary through wide ranges, it is, of course, necessary to build for maximum temperature conditions, such as maximum temperature of the available cooling water. If 80° is a safe figure note the money wasted by adding 5° as a further safety factor.

In passing, the committee reminds you of the paper presented by Mr. Benesh at the 1920 meeting, entitled "What happens in a Water Gas Set" as illustrating a further item of importance in connection with saturation temperatures.

Before leaving these considerations, there is one other phase of the condensing problem, which is, we believe, generally overlooked. That is, the functions performed by a condensing system are not to be calculated from

average temperature differences, but from *mean* temperature differences. Table (3) was prepared from Hausbrand's Formula.

The mathematics of the formula whereby the values in Table 3 were calculated may be found in Hausbrand's text book. To illustrate the use of the table, let us assume the following example:

A tubular condenser is operating under the following conditions:

Inlet gas temperature	180° F.
Outlet gas temperature	90° F.
Inlet cooling water temperature	70° F.
Outlet cooling water temperature	100° F.

Max. temperature difference (θ a)
$180° - 100° = 80°$ F.
Min. temperature difference (θ e)
$90° - 70° = 20°$ F.

$$\frac{\theta e}{\theta a} = \frac{20}{80} = 0.25$$

By reference to table 3, it is seen that when the ratio between minimum temperature difference and maximum temperature difference is 0.25, the mean temperature difference is 0.544 for each degree of maximum temperature difference. The maximum temperature difference in this case is 80° F., so the mean temperature difference is:

$$80 \times 0.544 = 43.5° \text{ F.}$$

Now if the average temperature difference had been taken as

$$\frac{80 + 20}{2} = 50° \text{ F.}$$

whatever condensing problem was being worked out would have been based on a temperature head nearly 6.5° higher than the correct one, and the results would have been in error by 14%.

It has not been possible this year to inaugurate any considerable amount of plant tests or research work bearing on condensing problems and conducted along carefully standardized lines. However, some doubt has been expressed as to whether there is any real difference between the *actual* temperature at the outlet of the hydraulic main or wash box and the *saturation* temperature at the same point. The simple expedient, therefore, was adopted of using a wet and dry bulb thermometer test to determine that point and the following results are submitted.

TABLE 3

VALUES FOR MEAN TEMPERATURE DIFFERENCE

Compiled by Steere Engineering Co.

θm = Mean Temperature Difference
θa = Largest Temperature Difference.
θe = Smallest Temperature Difference.

$\frac{\theta e}{\theta a}$	θm for $\theta a = 1$	$\frac{\theta e}{\theta a}$	θm for $\theta a = 1$	$\frac{\theta e}{\theta a}$	θm for $\theta a = 1$	$\frac{\theta e}{\theta a}$	θm for $\theta a = 1$
.0025	.166	.11	.404	.23	.526	.75	.872
.005	.188	.12	.418	.24	.535	.80	.897
.01	.215	.13	.430	.25	.544	.85	.921
.02	.251	.14	.440	.30	.583	.90	.953
.03	.277	.15	.451	.35	.624	.95	.982
.04	.298	.16	.461	.40	.658	1.00	1.000
.05	.317	.17	.466	.45	.693		
.06	.335	.18	.478	.50	.724		
.07	.352	.19	.489	.55	.756		
.08	.368	.20	.500	.60	.786		
.09	.378	.21	.509	.65	.816		
.10	.391	.22	.518	.70	.843		

TEST NO. 1

Vapor Content of Manufactured Gas

The tests were taken at the wash box of the water gas set and at the takeoff just above the hydraulic main. The method used was that of the wet and dry bulb thermometer. One thermometer bulb was covered with wicking kept wet by having one end dipped in water. The other thermometer was left exposed. The gases passed over the two thermometer bulbs, and if the gas was not saturated with water more would be taken up from the wicking around the thermometer bulb. Because of this evaporation, the bulb would be cooled, thus creating a temperature difference between the wet and dry bulb thermometers. These temperature differences, at various temperatures, have been tabulated with the corresponding percentages of saturation. These tables were consulted in finding the percentage saturated.

The apparatus, as seen from the drawing on page 15, sets in the gas stream, thus eliminating any jacketing or corrections for temperature changes. The gas entered through the side and just above the middle. It then passed down and then back up, passing as shown through the screen and around the thermometers before leaving the apparatus. Cotton was used, at first, around the tube to remove the tar and tar vapors. This, however, became saturated with water and thus gave the gas a different degree of saturation than it had originally. By removing the cotton and repeating the process, there was found to be an additional one degree temperature difference between the wet and dry bulb thermometers.

The screen used was of very fine mesh, such as is used to remove any drops of water found in gasoline. It was also put in the apparatus at an angle so that any water, that should happen to accumulate, would drain to one side and not remain spread over the surface of the screen. The drip in the bottom permitted the separated tar and water to drain out.

When the determinations were made of the water gas set, sufficient pressure was on the wash box to force the gas through the apparatus. When working with the coal gas, the gas had to be drawn through the apparatus because of the vacuum carried on the hydraulic and foul mains.

In the water gas determinations, there were some fluctuations in temperatures between those of the steam run, purge, and blow run, also blast. However, on the steam run, a dynamic equilibrium was soon reached and maintained until the purge. The tests were taken covering two periods of two hours each. The average temperature difference was three degrees Fahrenheit.

The percentage humidity was obtained from a curve plotted from the previously mentioned tables, the same being issued by the U. S. Weather Bureau. Plotting the curve for three degrees temperature difference, the percentage saturation was found to be 92.51%.

The determinations made on the coal gas covered four different periods. An equilibrium was soon attained and held. The temperature difference was practically constant, averaging 7 degrees F. From the curve, plotted for this temperature difference, the humidity was found to be 84.65% saturation.

Test No. 2

Report on Cooling and Condensing

1. Coal Gas

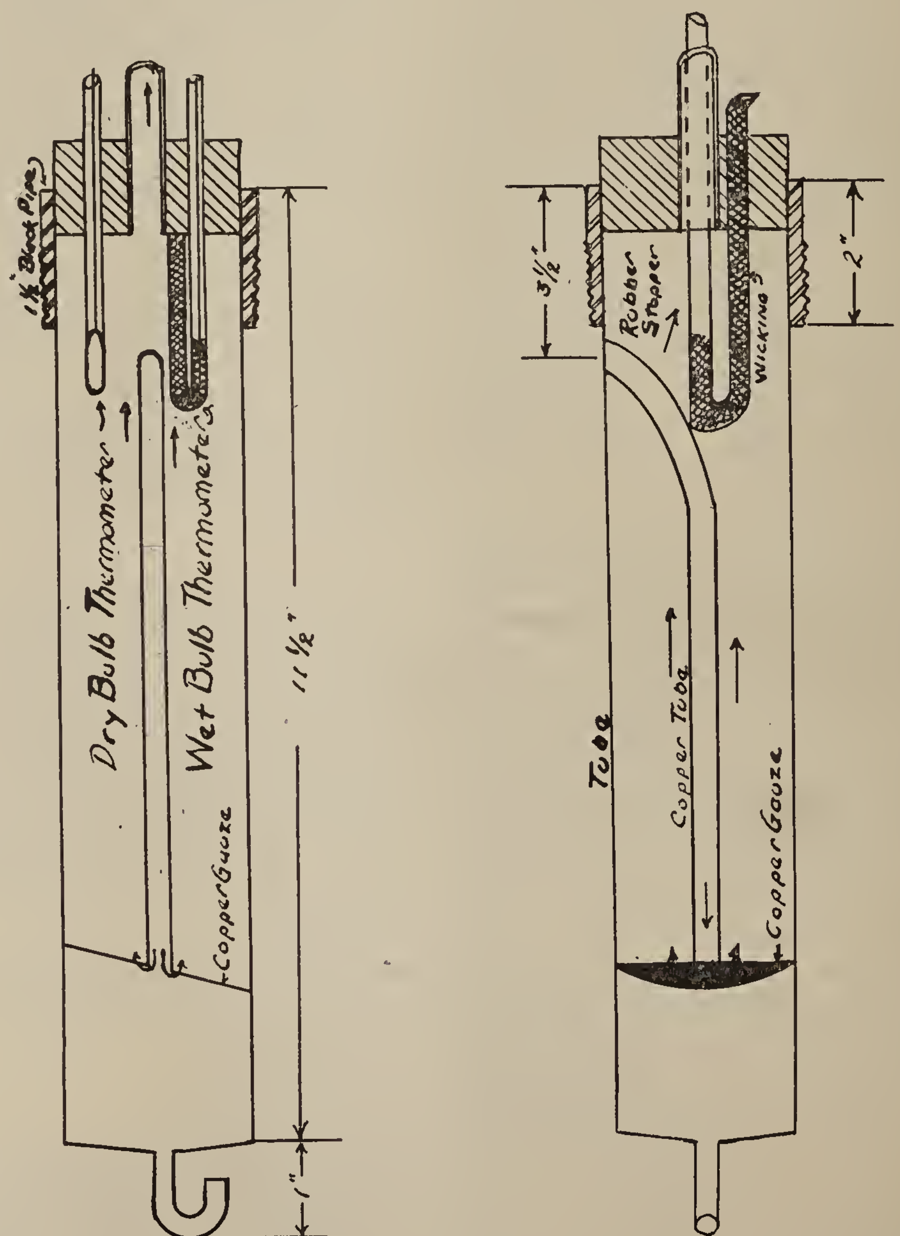
(a) Tests.

Mr. Benesh's test was merely a wet and dry bulb determination with a means for obtaining a constant dry bulb temperature. With coke oven gas, the gas temperature at the entrance of the primary coolers is approximately constant over a period of several minutes and a wet bulb test, simply made by putting wet and dry bulbs in the main seemed to work very well, in spite of the tar. The tests reported below check fairly well with the primary cooler test given, in which the moisture content of the gas was calculated from another angle.

The above test is so simple and obvious, yet seemed to give such consistent results that we are wondering if there is not some joker in it which we have not discovered.

Test No.	*Sat. Temp. Gas*	*Temp. Gas*	*Temp. Tar Flushing*
1	146° F.	152	—
2	159° F.	188	185

(b) Cooler Test.



Apparatus for Determining the Moisture Content of Gases

A test was run on the primary coolers sometime ago. In this test, the total heat absorbed by the water was found and it was possible then to calculate the only unknown, which was the amount of liquor condensed, and, in turn, the saturation temperature of the gas, which was found to be nearly that of the tar flushing. Accordingly, the gas was considered saturated at this temperature, and heat balances made for the two tests run.

The points brought out by these tests were: *First*—The gas was saturated at a temperature lower than the one at which it entered the coolers. *Second*—The saturation temperature was about the same as the one found by the wet and dry bulb method, made sometime later, though under somewhat different operating conditions as to quantities of gas, etc. *Third*—About 95% of the heat, absorbed by the cooling water, was due to the cooling and condensing of liquor and tar. Less than 5% was due to the loss in sensible heat of the dry gas itself.

Producer Gas Tests

(a) By calcium chloride absorption.

Last fall a number of tests were run on the moisture content of the gas leaving the waste heat boilers and entering the washer coolers. Some of these are given herewith.

Test No.	*Pounds Water per cu. ft. Gas at 60-30*	*Sat. Temp. °F.*
1	.0038	105
2	.0033	100.5
3	.0037	104
4	.0028	95
5	.0030	97

This content checked with the content calculated from moisture on the fuel and undecomposed steam content of the gas. These tests are of interest as checks to the wet and dry bulb tests.

(b) Tests with wet and dry bulb thermometers.

In these tests, an air cooled pipe was used instead of a steam jacket as outlined by Mr. Benesh. The time being short, we were not able to build the device described. The results obtained by the wet and dry bulbs, used with an air cooled pipe, seemed very consistent.

The average moisture content, based on one minute readings, taken for an hour, was .003 lbs./cu. ft. gas at 60-30, which, considering the moisture content of our fuel, etc., seems correct.

Test No. 3

On the outlet of the hydraulic main, we obtained a wet bulb reading of 116 degrees and a dry bulb reading of 135 degrees which, according to our tables, gives a saturation of 55%.

On the outlet of the water gas wash box, we did not obtain any difference between the wet and dry bulb readings which we believe was due to the high temperature of the gas at this point, which was 180 degrees during the run and 160 degrees during the blow. The steam consumption on our water gas set, during the time we attempted to make the test, was 24¾ pounds per minute. The above tests were made by inserting the dry bulb thermometer through a tap in the main and, as soon as the temperature reached the maximum point, the dry bulb thermometer was removed and the wet bulb inserted in its place. It is our opinion that this method is very crude and the results cannot be relied upon for accuracy.

Test No. 4

The tests were taken in the coal gas plant at a point where the hydraulic mains, one for a stack of ten benches and one for a stack of five, unite. At this point there are two spray tanks, and, of course, this would affect the results. Our tests showed practically complete saturation. The test in the water gas plant was taken at the off-take of the wash box. These tests also showed complete saturation. The psychrometer tests made are tabulated below.

Hydraulic Main Outlet

Date	*Dry Bulb*	*Wet Bulb*
6/1/23	148 deg. F.	148 deg. F.
2	152	152
4	149	150
5	150	148
8	152	152
9	149	150
12	155	152
13	149	149
15	152	150

Wash Box—Water Gas Plant

Date	*Dry Bulb*	*Wet Bulb*
6/1/23	178 deg. F.	177 deg. F.
2	193	192
4	190	190
5	185	182
8	194	193
9	194	194
12	188	186
13	175	176
15	190	190

The Committee is fully aware of the inadequacy of these tests and the possible criticisms of the methods used. As has previously been stated, no time was available for working out an acceptable standard method for conducting such tests. We believe, however, that they are illustrative.

It may be implied from the tests that the results shown represent stable or constant conditions at the plants where the tests were conducted. This is not necessarily the case, though for the purposes of our argument they may be so taken, for they clearly show that in certain instances, and under what we may assume to be usual operating conditions at the plants where the tests were run, complete saturation of the gas does not exist at the outlet of the wash box or the foul main. This condition and its constancy is what the individual operator is concerned with in considering his condensing equipment.

It is not infrequently the case that direct attempts are made to saturate the gas at the wash box or foul main. Whatever this accomplishes, it is well to bear in mind the relation of the scheme to the condensing problem.

The addition of water to the gas results in a lowering of gas temperature by the transfer of sensible heat in the gas to latent heat in the evaporated moisture, the total heat being still contained in the saturated gas. This cuts down the mean temperature difference between gas and outside air and reduces cooling by radiation which, as far as it is practicable, costs nothing. Further, it reduces the available mean temperature difference between gas and cooling water in the primary condenser, thus making it necessary to furnish more surface than would have been required had relatively hot dry gas been allowed to reach the condenser.

The Chairman: As part of the report of this committee, there is a paper to be presented, and I will therefore ask Mr. Earle to take the chair and introduce his speaker, and then later lead whatever discussion there may be on the whole subject.

W. H. Earle (Rochester, N. Y.): It seems to me that one of the encouraging signs of the last few years is the apparent rapidly growing interest in the industry's problems of scientific and technical men who are not directly in the industry. We were able this year to secure the interest of Prof. W. K. Lewis of the Massachusetts Institute of Technology in cooperation with our committee.

Prof. Lewis has devoted a good deal of time to research in many fundamental operations in various industries. Therefore, I feel greatly honored in being able to present to you at this time Prof. W. K. Lewis who will read his paper entitled "Factors in the Design of Absorption Apparatus."

FACTORS IN THE DESIGN OF ABSORPTION APPARATUS

W. K. LEWIS and W. H. McADAMS, Department of Chemical Engineering, Massachusetts Institute of Technology.

IN THE GAS industry there exist two types of problems each involving interaction of a gaseous mixture with a liquid, i. e., the absorption of some component from a gas by a liquid and the removal (stripping) from a liquid of some component by a gas or vapor. In all apparatus for this purpose the most important factors in design and operation are capacity and efficiency. The quantitative relation between these two factors is determined by the mechanism of the interaction. During recent years great progress* has been made in studying this mechanism and the purpose of this article is to present an analysis of these phenomena in the light of this progress. For simplicity the detailed discussion will be limited to absorption.

It is well recognized that when, at a given temperature, a vapor is dissolved in a liquid there is an equilibrium relationship between the partial pressure of the vapor and its concentration in the liquid, the nature of which varies with the substances in question. In general this relationship must be determined experimentally. For a given concentration in the solution the equilibrium vapor pressure always increases rapidly with temperature, the increase in most cases being nearly proportional to the increase in pressure of the pure condensed vapor. When liquid and gas are brought in contact under conditions such that the concentration of the liquid and the partial pressure of the vapor in the gas correspond to the equilibrium just described, no net interchange of solute takes place between the two phases. However, if the partial pressure of the vapor is greater than corresponds to this curve, solution takes place: if less, the material passes from the liquid into the gas.

From these facts alone it is obvious that in such an apparatus as an oil absorption system for light oil, it is physically impossible to build up in the absorbent oil a light oil concentration higher than that corresponding to equilibrium of the absorbent with the initial gas or to reduce the light oil content of the washed gas below that corresponding to equilibrium with the initial absorbent oil. Furthermore, since the partial pressure of any component in a gas mixture of definite composition remains unchanged, whatever the temperature, provided the total pressure does not fluctuate, it follows that the lower the temperature of absorption the higher is the attainable concentration of light oil in absorbent oil and the higher the limiting efficiency of absorption when using an absorbent of any given composition.

However, one is unable to attain these

*W. K. Lewis, J. Ind. Eng. Chem., Vol. 8, p. 825 (1916); Donnan and Masson, J. Soc. Chem. Ind., Vol. 39, p. 236T (1920); Van Arsdel, Chem. Met. Eng., Vol. 23, p. 1115 (1920); Whitman and Keats, J. Ind. Eng. Chem., Vol. 14, p. 185 (1922); Haslam, Ryan and Weber, Proc. Am. Inst. Chem. Engrs., Dec. (1922); Van Arsdel, Chem. Met. Eng., Vol. 28, p. 889 (1923); Whitman, Chem. Met. Eng., Vol. 29, p. 146 (1923); Baker, Chem. Met. Eng., Vol. 29, p. 500 (1923).

ideal results because of the low rate at which equilibrium is approached. The actual performance of an apparatus is therefore controlled by the rate of interaction between the two phases.

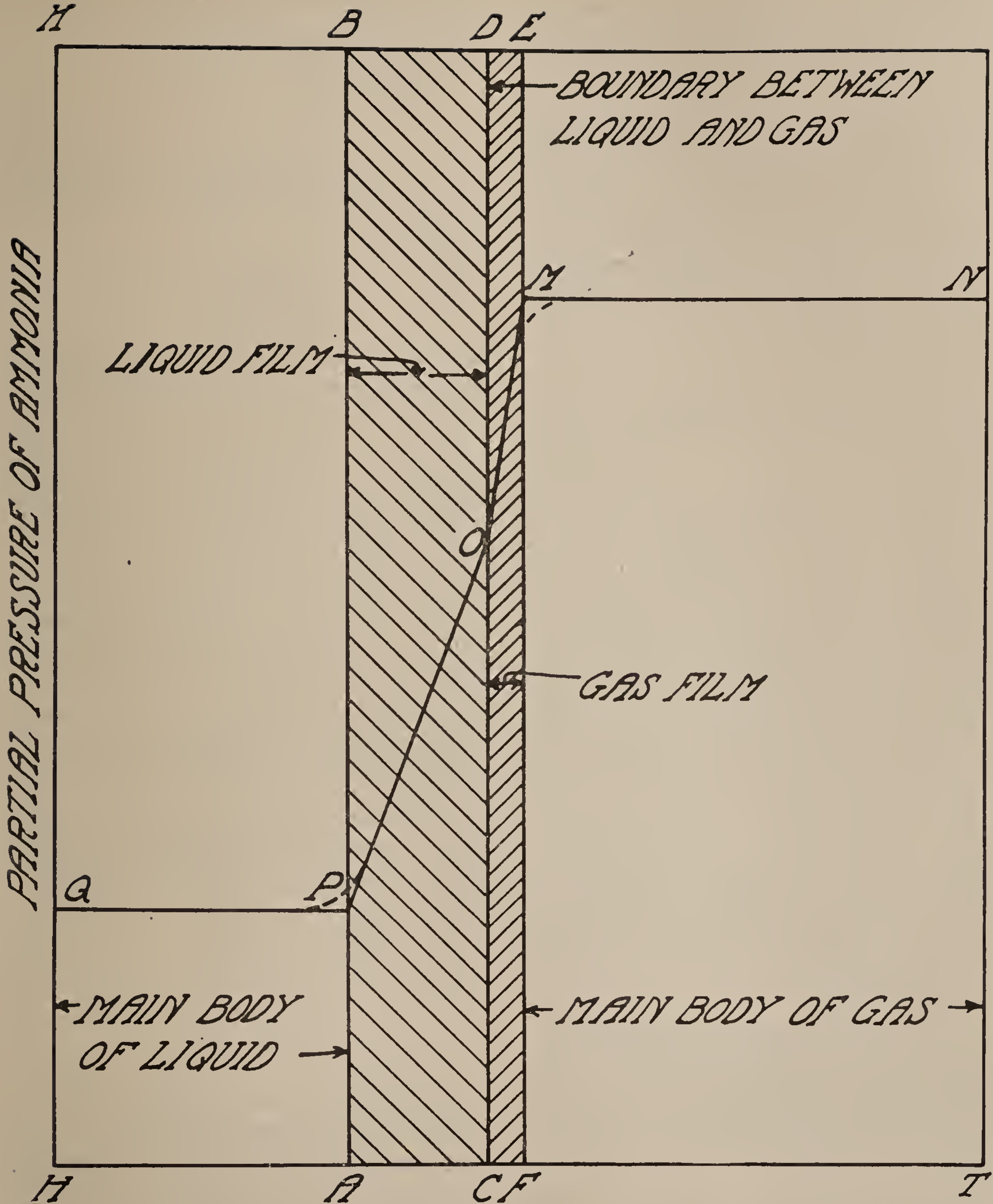
The absorption of a vapor from a gaseous mixture by a liquid, as for example that of ammonia by water or of light oil by a suitable solvent, is by no means a simple process. The main body of the gas is insulated from direct contact with the liquid by a film of the *gas,* the motion of which is so slight that it may be considered as stationary. Furthermore, mixing of the main mass of the liquid with its surface is imperfect, due to the existence, on the surface of the liquid, of a *liquid* film of the same general characteristics. For an ammonia molecule to get from gas into water it must first be carried, mainly by convection, to the outer surface of the stationary gas film separating the water from the body of the gas. It must then diffuse through this gas film, and this diffusion can take place only under the impulse of a concentration gradient. It must now penetrate the true boundary surface between the water and the gas. The molecule must then diffuse through the film on the liquid side of the boundary surface between the phases, and finally be carried from the inner surface of this film into the mass of the liquid by convection. We are dealing therefore with five separate phenomena, each of which interferes with the result which it is desired to attain. Each of these factors must be considered in studying that result and the controlling influence is due sometimes to one and sometimes to another of them. Indeed, not infrequently several of these factors are of such importance that they should not be overlooked.

Fortunately, the problem is simplified by the fact that in all cases the movement of the ammonia is controlled by and is proportional to the concentration difference, i. e., the transfer of ammonia from gas to water follows laws of the same type as those governing the flow of electricity or the flow of heat. Exactly as in these two analogies the phenomena can most readily be studied by assuming rate of flow proportional to potential difference over resistance, i. e., in the case of electricity to voltage drop over electrical resistance and in the case of heat to temperature drop over thermal resistance, so in this case rate of diffusion is proportional to concentration difference or its equivalent as the driving force divided by diffusional resistance. This makes it possible, as in dealing with electricity, to treat additively the series resistances encountered.

In most cases, the resistance to flow by convection in a relatively free space of either vapor or liquid is slight. In consequence it is usually possible to neglect these two factors. Furthermore, under normal conditions, it is probably true that interaction between the surface of a liquid and of a gas in immediate contact with it is so rapid that an abrupt drop in concentration at this surface either does not occur or is at most very slight. This therefore means that we are normally dealing with the resistances of two fluid films,* i. e., of the stationary gas film insulating the gas from the liquid and of the stationary liquid film separating the liquid from the gas. Through each of these films rate of diffusion is strictly proportional to the concentration gradient.

Since the concentration of a vapor in a gas is proportional to its partial pressure, and this is more easily visualized

*W. G. Whitman, Chem. Met. Eng., Vol. 59, No. 37 (1923).



than gaseous concentration, it is usual to employ partial pressure rather than concentration when dealing with the gaseous phase.

The mechanism of absorption of a vapor from a gas by a liquid will be made clearer by the accompanying diagram. The line CD represents the interface between a gas containing ammonia and water in contact with it. The concentration of the ammonia in both gas and liquid are plotted upward from the line HT as a base, but these concentrations are expressed as the equivalent partial pressure which, if the solutions be not too concentrated are, in all cases substantially proportional thereto. The partial pressure in the main body

of the gas is represented by the line MN. Through the gas film CDEF, the concentration of ammonia drops off linearly along the line MO. At O, the point of contact with the liquid, liquid and gas are at equilibrium or substantially so. Through the liquid film, ABDC, there is another concentration drop, OP. Within the main body of liquid the concentration remains substantially constant at the value QP.

These lines are somewhat diagrammatic. Thus it is not intended to claim that the lines MN and QP are absolutely horizontal, but nearly so. Undoubtedly the lines OM and MN blend into each other by a curve somewhat as indicated in the dotted line. The same is true on the liquid side. If, however, one assumes the relations as originally drawn the results correspond quantitatively to the experimentally determined data, at least within the precision of the available data.

In the main body of both gas and liquid uniformity of concentration is maintained by convection. Through the surface film the ammonia movement is caused by diffusion and the concentration gradient is the factor maintaining this movement.

The rate of diffusion through the *gas* film is therefore proportional to the drop in partial pressure through the film, to its area A, and inversely to its thickness, i. e.,

$$\frac{dW}{d\theta} = \frac{\Delta p}{r_g} = \frac{K_g A \Delta p}{L_g} \quad \dots\dots\dots\dots\dots (1)$$

However, in this equation, as a general proposition it is impossible to determine the film thickness. Consequently this indeterminate film thickness, L, is incorporated with the diffusion coefficient, K, and their ratio is replaced by a new coefficient, k, giving:

$$\frac{dW}{d\theta} = k_g A \Delta p \quad \dots\dots\dots\dots\dots\dots\dots (1b)$$

In a similar way the rate of diffusion through the liquid film is expressed by the equation

$$\frac{dW}{d\theta} = \frac{\Delta c}{r_L} = \frac{K_L A \Delta c}{L_L} = k_L A \Delta c \quad \dots (2)^*$$

In both these equations the area, A, is the same and equal to the *total* area of contact between gas and liquid. Occasionally this quantity is determinate, but usually it is not. Different types of apparatus differ primarily and essentially in the method employed to create surface of contact, i. e., to make this quantity A as large as possible and thereby improve capacity and efficiency. In a given type of equipment the effective contact area per unit of volume has a characteristic value despite the fact that the numerical value of this term is usually unknown. This quantity will be called "a." "A" therefore becomes aV and the equations may be written as follows:

$$\frac{dW}{d\theta} = \frac{\Delta p}{r_g} = (ka)_g V \Delta p \quad \dots\dots\dots\dots (1c)$$

$$\frac{dW}{d\theta} = \frac{\Delta c}{r_L} = (ka)_L V \Delta c \quad \dots\dots\dots\dots (2b)$$

where V is the total value of the apparatus, less any inactive portions.

Where the absorption is isothermal throughout and the concentration of the material absorbed follows Henry's law (i. e., is proportional to its partial pressure) up to the highest concentration encountered in the operation, the equations are integrable, giving*

$$\frac{W}{\theta} = (ka)_o (\Delta P)_{av} = (k'a)_o (\Delta C)_{av} \quad ..(3)$$

*Δc is the concentration drop through the liquid film, while ΔC is the overall drop in concentration through both films; Δp is the drop in partial pressure through the gas film, while ΔP is a similar overall drop through both films.

$$\text{or} \quad \frac{W}{\theta} = \frac{(\Delta P)_{av}}{\frac{1}{(ka)_g} + \frac{1}{(ka)_L}} = \frac{(\Delta C)_{av}}{\frac{1}{(k'a)_g} + \frac{1}{(k'a)_L}} \quad (3a)$$

$$\text{since} \quad (ka)_o = \frac{1}{\frac{1}{(ka)_g} + \frac{1}{(ka)_L}}$$

$$\text{and} \quad (k'a)_o = \frac{1}{\frac{1}{(k'a)_g} + \frac{1}{(k'a)_L}}$$

where $(ka)_o$ is the *overall* coefficient from gas to liquid.

In these equations for the average value of partial pressure or concentration difference one employs the logarithmic mean* of the initial and final differences. Fortunately, in the majority of absorption processes encountered in industrial practice the deviation from these conditions is sufficiently slight so that the equations can be used in this form. Thus, this is true in the absorption of ammonia by water and of light oil by straw oil or cresole as carried out in the purification of gas from the distillation of coal. The solutions produced must not be too concentrated and the temperature variations during absorption should be low, preferably below 10° and certainly not over 20°F.

When, however, one computes the overall coefficient $(ka)_o$ or $(k'a)_o$ for a given type of apparatus operating under variable conditions, one finds wide variations in the result. This is at first disconcerting until one realizes that this coefficient is influenced by two factors, both of which are profoundly subject to operating conditions, i. e., by the thicknesses of the two surface films. By far the most important factor in determining such film thickness in an apparatus of a given design is the velocity through the apparatus.**

Furthermore, since one would anticipate that the thickness of the gas film would be determined primarily by the gas velocity and of the liquid film by the liquid velocity, one must expect an influence of velocity of *both* gas and liquid on the capacity coefficient $(ka)_o$, of any given type of equipment. Experimental tests on absorption operations should always be planned to bring out this relationship.

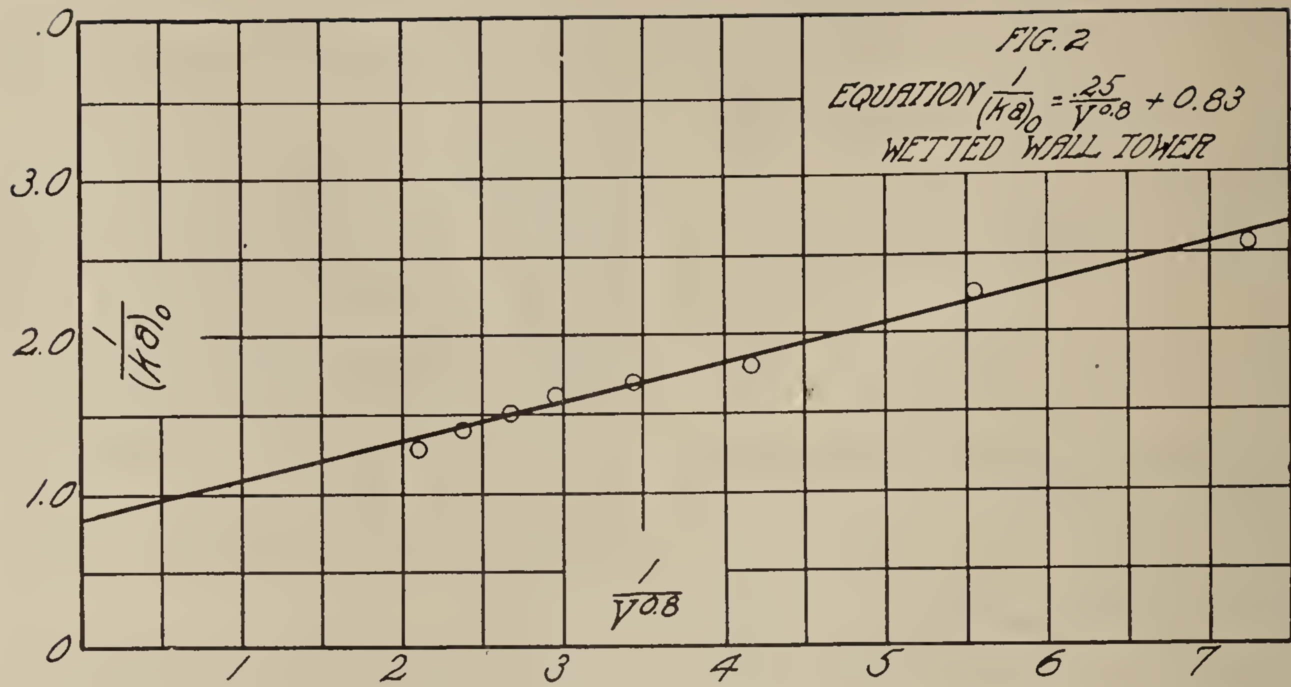
Unfortunately, there are available no data on either ammonia or light oil recovery sufficiently detailed to illustrate quantitatively the effect of both velocities. Recently, however, data have been published*** on the absorption of sulphur dioxide gas in water, which clearly illustrate this velocity effect. These authors report a series of tests, the water rate being constant in each series, but the gas velocity varying. One would, therefore, anticipate that the water film resistance would be substantially constant in each series, but that the gas film resistance would decrease as velocity increases. Furthermore, a mass of other data**** indicates that gas film resistance decreases approximately as the inverse eight-tenths power of gas velocity. Since the resistances of the two films are additive, one would therefore anticipate the relationship, $1/(ka)_o = r_L + b/v^{0.8}$, where r_L is the resistance of the liquid film and b a constant. Hence, if one plots $1/(ka)_o$ versus $1/v^{0.8}$, one would expect a linear relationship in each series. The data are presented in the accompanying diagrams plotted in this way. The results

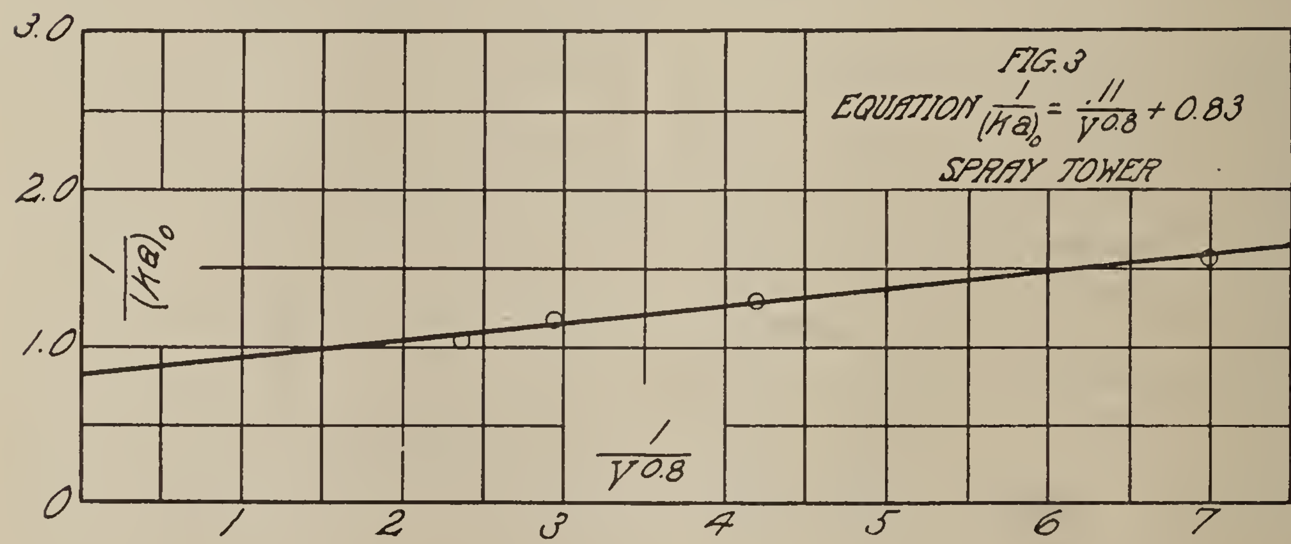
*The logarithmic mean of two quantities, a and b, is defined as $(a-b)/\log_e (a/b)$. This integration can be found in Jour. Ind. Eng. Chem., Vol. VIII, p. 825, 1916. Whether one uses pressure or concentration difference is optional.

**See discussion in "Principles of Chemical Engineering," Walker, Lewis and McAdams, McGraw-Hill Book Co., Inc., pages 36-42, 138-142, and 438-442.

***Haslam, Ryan and Weber, Proceedings Am. Inst., Chem. Engrs., Dec., 1922.

****See references to "Principles of Chemical Engineering," loc. cit.

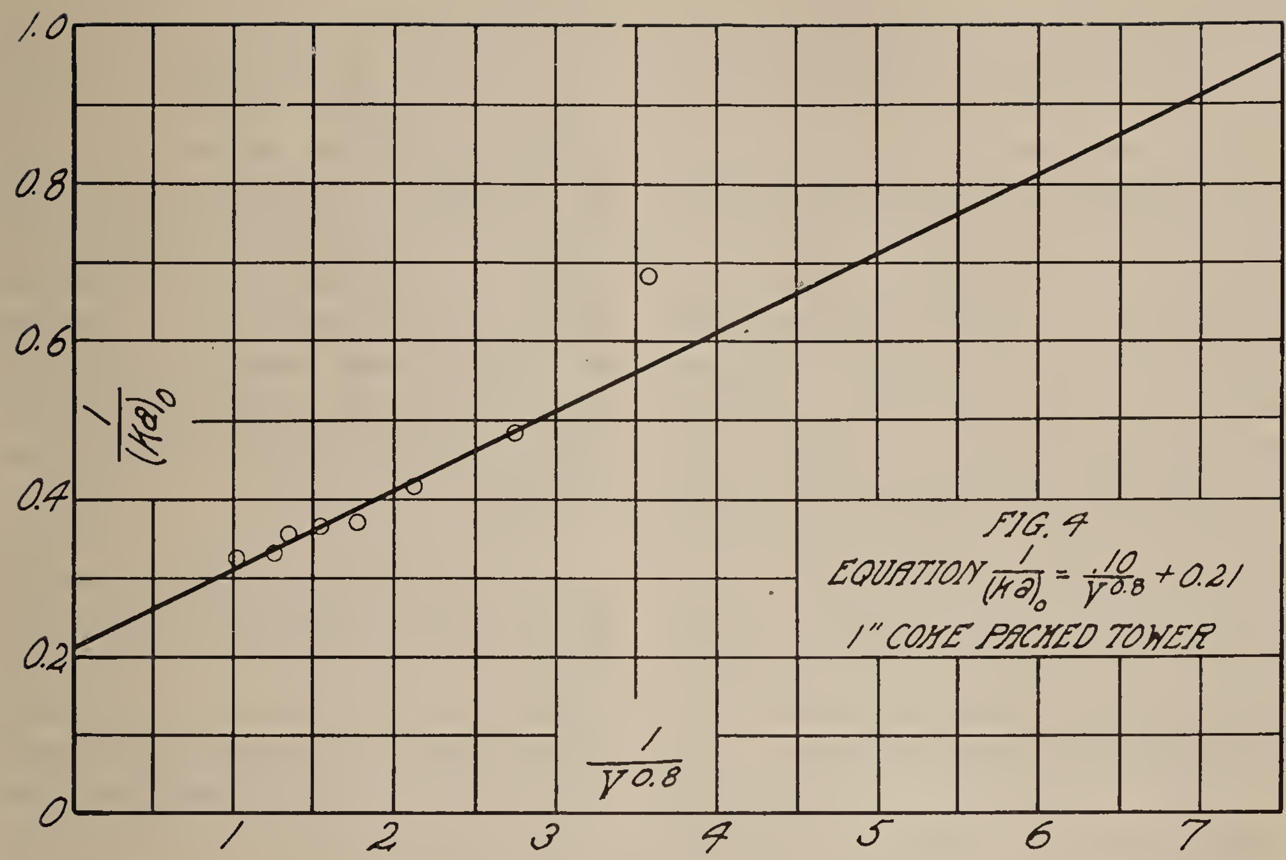


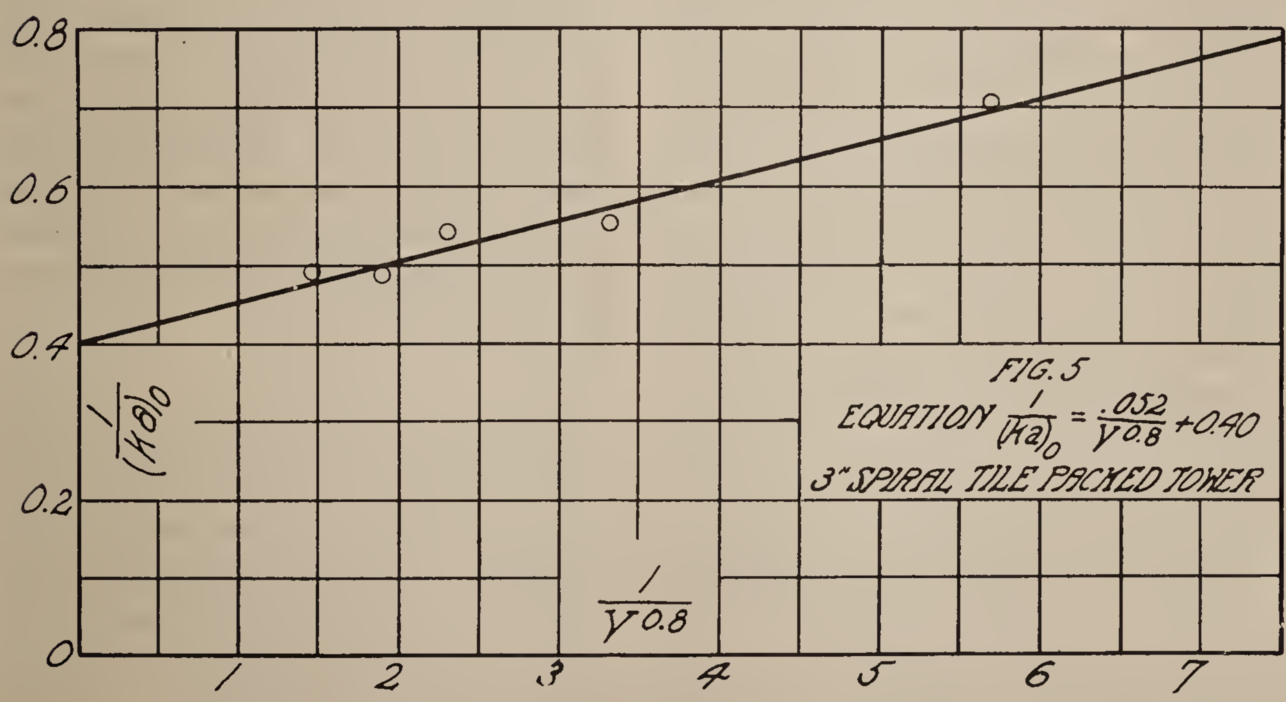


are striking, and substantiate the validity of this method of analysis.

From the relationship just developed it will be seen that the intercept of these lines on the vertical axis is the liquid film resistance for each type of equipment. An empty tower with wetted walls has a high resistance, approximately 0.8 in the units given. A spray tower has substantially the same liquid film resistance, for reasons discussed in the next paragraphs. A tower packed with 1-in. coke has only one-fourth this resistance, while three-inch spiral tile gives one-half. These comparisons are not entirely legitimate because the water rates were not in all cases identical. Accurate data as to influence of water rate in these different types of equipment are not available, but indications are that the liquid film resistance is much less sensitive to change in water velocity than that of the gas film. It is obvious that this change can be determined by a series of experiments in which gas velocity is maintained constant with variable water rates.

An empty tower with wetted walls has a high resistance because of the small surface area of contact between liquid and gas. Where the same tower is packed with coke, the contact surface is





far greater and the resistance is correspondingly reduced. However, the reduction is by no means proportional to the increase in area due to the coke, because it is usually impossible to keep all the coke surface wetted. Furthermore, the decreased diffusional resistance is obtained at the expense of greatly increased pressure drop of the gas flowing through the tower.

Thus, if a small volume of concentrated gas is to be treated, one could afford to use coke packing, where this would be out of the question in handling a large volume of dilute gas. Spiral packing is intermediate, both in dif-

fusional resistance and in pressure drop. In all three of these types, under normal operating conditions, the liquid flows over the solid surface in a straight line or viscous motion and increased water rate merely increases the thickness of the liquid layer on the filling. In viscous flow there is no mixing within the body of the liquid by turbulence or convection, so that the general character of the surface film remains unchanged. However, increased water rate will somewhat increase the wetted surface. Consequently, one would expect diffusional resistance to decrease with increased water rate, but not in proportion thereto. This explains why the effect of water rate is less than that of gas velocity.

Spray towers produce an extremely large surface area of liquid in contact with the gas, but each individual droplet settles out so quickly that, while its surface comes into substantial equilibrium with the gas, diffusion from the surface toward the interior of the droplet being poor and the time factor short, the whole interior of the droplet is ineffective. Hence, to secure good results, the liquid collecting by coalescence must be atomized again and again. Equipment to accomplish this cheaply has not been easy to develop. Furthermore, in spray operation, the relative motion of drop and gas is almost independent of gas velocity. If the gas is moving slowly the drop falls almost perpendicularly, while if the gas is moving horizontally the drop is carried with it, but its vertical motion and consequently its time of exposure to gas remains unchanged. Hence, gas velocity has little influence on the resistance of the gas film, as is obvious from inspection of the diagrams shown above.

Bubble-plate columns give excellent contact of gas and liquid but high back-pressure. Since the time required for a bubble to rise through a given level of liquid is independent of the number of bubbles passing the section, it follows that diffusional resistance changes but slightly with gas velocity, provided the velocity is not sufficient to blow the liquid off the plate. It is also obvious that liquor velocity cannot greatly influence the resistance. These towers have therefore remarkably uniform tower coefficients.

In the absorption problems of the gas industry the liquid film resistance is usually the major one. Consequently, it is necessary not only to expose large surface, but also to leave that surface in contact with the gas sufficient time to secure diffusion through the liquid film. This explains the success of that type of equipment in which a thin film of liquid is carried up into the gas space, held there for an appreciable time and then returned to the body of the liquid. For spray equipment to compete with this type it is necessary to greatly increase the surface exposure or else to reform the surfaces repeatedly.

In the preceding discussion it has been assumed that during the absorption process the solution follows Henry's law and that the temperature remains substantially constant. Important cases come up in which these assumptions are no longer valid. In general such cases must be analyzed individually. One case of this type, interesting to the gas industry because its use there has been tentatively suggested, is the removal of carbon dioxide from gas by absorption in sodium carbonate solutions, the carbon dioxide being expelled from the bicarbonate by heat. In this case the equilibrium partial pressure of carbon dioxide over the solution does not follow

Henry's law because of the chemical combination taking place. In the operating range a small increase in the carbon dioxide content of the solution produces a relatively large increase in its partial pressure. This results in very great difficulty of absorption. The surface of the liquid in contact with the gas need pick up but little carbon dioxide in order to reach equilibrium. On the other hand, diffusion through the surface film is due to the concentration gradient of bicarbonate and since this is small the diffusion is very slow. So serious is this factor in plants producing liquid carbon dioxide from flue gas by this method that an absorption of only 50% of the carbon dioxide in the gas is not considered unsatisfactory.

As already indicated, the equations here presented are strictly analagous to the equations ordinarily employed for flow of heat. The performance of industrial equipment for heat transfer, such as heat exchangers, the heating surface of stills, evaporators, and the like, is expressed as a coefficient of heat transmission. While every engineer appreciates that this coefficient is not the sole factor in determining the economic value of a given apparatus, he recognizes that it gives him the simplest and best basis for comparison to help him evaluate the relative significance of other factors. The capacity coefficient $(ka)_o$, which we propose for adoption in quoting the performance of absorption equipment has exactly the same limitations and value. While for a given purpose an apparatus with a low coefficient may be economically best suited, this is true despite the fact that this apparatus possesses the disadvantage of low capacity, and its relative disadvantage can be expressed most clearly by quoting this coefficient and comparing it with the coefficients of other types of equipment.

This method of presentation of results can perhaps most readily be made clear by applying it to data with which you are familiar, i. e., to the results of tests on a series of Doherty scrubber compartments reported by Mr. J. R. Wohrley at your 1922 Convention and given in the form of curves on page 369 of Vol. IV of your Technical Proceedings. The following table is constructed from these curves. The first column gives the number of scrubber compartments through which the gas has flowed.* The second shows the ammonia in the gas after having passed the compartments indicated, as read from the curves of Mr. Wohrley. The third gives the ammonia absorbed by the liquor up to the point in question as shown by the drop in concentration in the gas, expressed in the same units as before. The next column is the same figure converted into pounds of ammonia absorbed per minute. Next is given the partial pressure of the ammonia in the gas as millimeters of mercury, computed from the second column on the assumption that the pressure in the scrubber was atmospheric. Because of the large amount of carbon dioxide and hydrogen sulphide in the gas relative to ammonia, the ammonia in the liquor will be largely in the form of bicarbonate and bisulphide, except as stronger acids are present to combine with it. While the two salts mentioned dissociate sufficiently to give an appreciable partial pressure of ammonia, this is small compared with the total ammonia concentration. Consequently we have neglected the back pressure of ammonia at each particular point in the apparatus. The back pressure in the liquor leaving the scrubbers may be very

*It was impossible to read the curves beyond the fourth absorber.

large compared with the ammonia concentration at the other end, but is small relative to the partial pressure of the gas with which it is actually in contact. With this assumption, we have computed the logarithmic mean partial pressure difference effective in producing ammonia absorption and in the last column the corresponding value of $(ka)_oV$.

Scrubbers Passed	Ammonia in Gas, Grains/10° cu. ft.	Ammonia Absorbed, Grains/100 cu. ft.	Ammonia Absorbed Lbs./min.	Pressure of Ammonia in Gas, Mm.	Log Mean Δ p, Mm.	$(ka)_oV$
0	184	—	—	4.46	—	—
1	98	86	0.380	2.38	3.32	0.114
2	61	123	0.543	1.48	2.70	0.101
3	31	153	0.676	0.75	2.08	0.108
4	11	173	0.764	0.27	1.49	0.128

The average of these coefficients, $(ka)_oV$, is 0.113. The average deviation from the mean is a trifle over 7%, while the maximum deviation is 13%. It will be noted that the ammonia concentration varied more than sixteen-fold. If an engineer, testing four units of a heat exchanger in which the temperature difference varied sixteen fold, found coefficients of heat transfer varying as little as 7%, he would be pleased with the results. We therefore feel justified in asserting that this method of presenting the results of tests of absorption equipment is sufficiently practical to be worthy of more general adoption.

Using as the dimensions of these scrubber units the figures given in the earlier part of Mr. Wohrley's article, one obtains a value $(ka)_o = 0.00068$ lbs. of ammonia per minute per cu. ft. of total volume per mm. of mercury pressure difference. Unfortunately the $(ka)_o$ values are not available for most other types of equipment, because in the past, data have not been reported in this form. As the results of measurements available to the authors we know that slat towers of the usual type give $(ka)_o$ values of approximately 0.00022 at superficial gas velocities of 1.8 ft. per sec., while ordinary bubble plate columns at superficial gas velocities around 0.5 ft. per sec. give 0.003 in the same units, a figure about fourteen times as high.

It is rarely the case that two installations operate under comparable conditions. It is therefore impossible by present methods to accurately compare the capacity factors of the two units. This method of computations and presentation of results gives such a comparison.

The removal of a volatile component from a relatively nonvolatile liquid is accomplished by a process essentially the reverse of that just discussed, i.e., by absorbing the volatile component from the liquid into a gas or vapor, usually steam. The flow of the liquid and steam is counter current, in order to secure efficient removal. Effective contact can be provided by any of the types of apparatus used in the preceding case, though usually bubble-plate columns are employed.

Using the removal of light oil from absorbent oil as an illustration, the ratio of the weight of light oil to the weight of steam in the distillate is given by the formula

$$\frac{W_o}{W_s} = \frac{M\,p_o}{18\,p_s} = \frac{M\,p_o}{18\,(P - p_o)}, \text{ where}$$

W_o is the weight of light oil distilled and W_s the weight of steam coming over with it. M is the molecular weight and p_o the partial pressure of the light oil leaving the still or column. P is the total absolute pressure on the still and p_s is the partial pressure of the steam. 18 is the molecular weight of steam.

Since in such a distillation the very

large heat content of the steam is not effectively utilized, it is essential to keep the steam consumption down to a minimum, i. e., to have this ratio as large as possible. Since the molecular weight of the light oil is beyond control, the only way of saving steam is to increase p_o or to decrease P. p_o can be increased by raising the temperature of the liquid at the top of the still or column, and this temperature should be kept as high as possible without undue volatilization of the absorbent oil. Reduction of the total pressure, P, is another means of reducing steam consumption which can be made even more effective. Thus in a stripping column in a modern American plant operated at atmospheric pressure the consumption of live steam per pound of light oil distillate, of average molecular weight 85, is 5.3 lbs. Using the above formula, one finds that the partial pressure of the light oil vapor leaving the still is 29.2 mm. It should be noted that this is not the vapor pressure of light oil, but its partial pressure under the conditions actually obtaining in the top of the column. If this column were put under a 24″ vacuum (6″ absolute), other operating conditions remaining the same, the partial pressure of the light oil in the top of the column would remain unchanged. However, using the same formula, one sees that the steam consumption would in this case be reduced to 0.895 lbs. per lb. of light oil distillate, i. e., a saving of 83% of the live steam at present employed. Operating practice has substantiated this conclusion. In view of these facts it is surprising that so many American plants still operate their stripping columns at atmospheric pressure.

In order thoroughly to strip the absorbent oil, and as explained above, this is of great importance for high absorption efficiency, its temperature must be maintained high. If this is done by condensation of live steam alone, the temperature limit is that corresponding to the pressure of steam in the still, e. g., at atmospheric pressure to 212° F. There is no need to adhere to this limit. The column should be heated, usually by closed steam coils under pressure. The temperature can be raised above that at the top of the column, even though a certain amount of vaporization of the absorbent oil results. This vaporization can be rectified out in the upper part of the column. Furthermore, since most of the light oil is vaporized in the top of the stripping section of the column, this part requires more heat than the bottom. While to secure complete stripping it is desirable to have the total pressure as low as possible, the back pressure developed by the bubble plates of the column can readily be more than compensated for by increase in temperature at the bottom of the column, and under these conditions the steam necessary to carry over the distillate at the top of the column is amply adequate for thorough stripping.

Since the absorbent employed is always slightly volatile, a certain amount of it will go over with the distillate if the rich absorbent oil is fed to the top plate of the column. If, however, one will introduce the feed a few plates below the top and provide a slight reflux by means of a partial condenser or, better still, by returning a small fraction of the light oil distillate to the top plate, all the absorbent will be rectified out of the distillate and the distillate will come over substantially free of absorbent oil.

By the use of these three modifications in operation, i.e., vacuum on the column,

closed coil heat supply or its equivalent at the proper points in the column, and introduction of the feed a few plates below the top with a slight reflux of distillate on the top plate, the height of existing columns can be decidedly reduced, the efficiency of stripping greatly increased, and the steam consumption lessened to a marked degree. Furthermore, in many existing columns the necessary changes can be made at slight expense.

These statements do not apply to columns for the separation of components, the volatility of which is not widely different, as for example in the stripping of ammonia from water. In such cases, the higher the pressure under which a column is operated, the greater is its capacity and as a general proposition, pressure does not appreciably affect the ease of separation.

DISCUSSION

F. J. Ikena (Baltimore, Md.): In the report of the committee, under date of June 13th, you show a temperature of 175 degrees and on June 15th a temperature of 190 degrees. To what cause in operation do you attribute this 175 as compared to the 190?

Then again the report states:

"It is not infrequently the case that direct attempts are made to saturate the gas at the wash box or foul main. Whatever this accomplishes, it is well to bear in mind the relation of the scheme to the condensing problem," etc.

This statement is not entirely clear. By what means is this achieved and what are the arguments therefor?

W. H. Earle (Rochester, N. Y.): I am not prepared to answer Mr. Ikena's question on the temperatures. As to the paragraph on the last page, it is simply a reference on our part to efforts which are made, for instance, in scrubber standpipes or in sprays inserted in standpipes of water gas sets or mains of coal gas operation. Without attempting to argue as to why that is done, we are simply calling your attention to the possible influence of that on the condensing problem itself.

J. E. Brewer (W. Conshohocken, Pa.): Prof. Lewis stated that a vacuum on a scrubber would save about a third of the steam consumption. Does Prof. Lewis have any figures of the comparative steam consumption in a light oil still with and without vacuum?

W. K. Lewis (Boston, Mass.): I am not a gas man and therefore I know nothing about light oil. I have never operated a stripping still, under atmospheric pressure, because I did not want to waste the steam. I have debenzolized pure benzols from straw oil with steam consumptions of 7 pounds per gallon. That is the only data I have.

H. C. Adams (Pittsburgh, Pa.): I am with the Equitable Gas Co. in Pittsburgh, and we handle natural gas in operating there. Several people connected with that work and the government have done a lot of work on saturation points, and I think it would be a pretty good idea for some future committee to cooperate with those men and the government in order to study this question. I have been in Pittsburgh now for three years, and I see that there is a great field there for future work, and natural gas companies have studied it and have gotten some data.

W. J. Huff (Pittsburgh, Pa.): The very excellent method of computation which Prof. Lewis has explained, has

been used by himself and associates, and the Massachusetts Institute of Technology. Many others have followed that work with a great deal of interest and obtained a great deal of help from it. But there are a great many practical difficulties involved.

Take the case of light oil absorption which Prof. Lewis mentions slightly. He shows on his tables a delta P which is a pressure difference. Now that delta P is sometimes very difficult to obtain. In ammonia scrubbing it is relatively easy because we happen to have the data on the vapor pressure of the ammonia solutions, and from an analysis of the solutions we can compute the theoretical vapor pressures. Consequently, from the knowledge of the ammonia and the gas and the amount of ammonia in the water we can calculate this delta P very readily. But when you begin absorbing light oil, which is a rather complex mixture of hydrocarbons of various vapor pressures and various compositions, and begin to calculate a delta P when you are using a straw oil of unknown weight, it is exceedingly difficult to get much out of it with the data which we have at hand. I am commenting upon this, not in any way to detract from the underlying theory, which I regard as very commendable, but to emphasize the need that we have for technical data of just that character.

We have this very problem in the Koppers Company in connection with the absorption of hydrogen sulphide from gas in sodium carbonate solutions. Now the vapor pressure of hydrogen sulphide in solution depends upon a very great many complicated factors, and I know of no place to turn to find out what the true vapor pressure of such a solution is without actually determining it in the laboratory. And it will be necessary, before this method of computation can be employed in such a case, to actually get such laboratory determinations.

Now, that will involve some additional work; maybe it pays, but it is exceedingly difficult to get a practical man to do all of that when he has not the data to compute from or when he must run some additional test to get to that.

I want to say a word for the practical mind. The great development in this gas industry has been surprising when you consider the many complex things that must be encountered physically and chemically. This matter of absorption of light oils in straw oils is just one of those things. I do not know how to get around it other than to suggest that the American Gas Association form a committee of men who will collaborate in the compilation of a set of tables which will give us some information on these various vapor pressures.

Upon invitation, Mr. A. C. Fieldner assumed the chair.

REPORT OF THE CHEMICAL COMMITTEE

*A. C. Fieldner, *Chairman,* Pittsburgh, Pa.

The 1923 Chemical Committee, consisting of 24 members, was organized in January, held its first meeting in New York on February 9, second meeting in Chicago, Ill., on March 13, and the third and final meeting at Atlantic City, N. J., on June 27.

All meetings were well attended. The second and third meetings were held jointly with the Committee on Purification and the Committee on Deposits in Gas Pipes and Meters, the latter two committees being under the general supervision of the Chemical Committee.

Committee on Deposits in Gas Pipes and Meters, R. L. Brown, Chairman.—The Committee on Deposits in Gas Pipes and Meters has carried on, in cooperation with the U. S. Bureau of Mines, fundamental research on the nature, formation, and prevention of gummy deposits. Several papers have been published during the year, and a comprehensive progress report will be presented at this meeting by the Chairman. In carrying out this investigation, the U. S. Bureau of Mines contributed the services of Dr. R. L. Brown, organic chemist, one assistant chemist and laboratory facilities of the Pittsburgh Experiment Station. The American Gas Association paid the salary of one assistant chemist and the traveling and other expenses of the men engaged on the work; and some of the member companies contributed services of their staff and equipment in making tests at gas plants.

As the chemistry of the highly complex organic compounds entering into gum formation is but little known, the committee has been obliged to devote much of its energy to a study of the chemistry of these substances in order to determine their composition and reaction. A full knowledge of these properties is a necessary prerequisite for solving the gummy deposit problem. It is hoped that work on this subject can be continued for another year, when it is believed a fairly complete solution to the problem will have been obtained.

Committee on Purification, A. R. Powell, Chairman.—The report of the Purification Committee will be presented separately by the Chairman, Dr. A. R. Powell.

Sub-committee on Air Needed for Revivification in Situ in Purification, J. F. Wing, Chairman.—The report of the

*Superintendent and supervising chemist, Pittsburgh Experiment Station, U. S. Bureau of Mines.

sub-committee on "Air needed for revivification of iron oxide in situ" is included in the report of the Deposits Committee, as the investigation was suggested in connection with the reduction of gum deposit trouble by reducing the oxygen content of gas to the minimum requirement for revivification of iron oxide. Tests at five different gas plants showed that under all the conditions existing at the time of the tests, considerably less admitted air would have served the purpose desired and less surplus oxygen would have passed on to react with the unsaturates to form gums in the meters.

Sub-committee on Editing the Gas Chemists' Handbook, E. C. Uhlig, Chairman.—The sub-committee on editing the Gas Chemists' Handbook, E. C. Uhlig, Chairman, C. C. Tutweiler and O. A. Morhaus, was continued as a standing committee to take charge of the revision of the Gas Chemists' Handbook. The changes in methods recommended by the various sub-committees on cooperative tests of methods, after approval by the Chemical Committee, are to be incorporated in the next revised edition of the handbook. Through cooperative analyses of carefully prepared samples each section of the book is to be critically tested. In 1921 and 1922 the chapters on gas coal and coke were thoroughly tried out by analysis of standard samples. During the present year cooperative analyses have been undertaken on ammonia liquor and materials by a sub-committee under the chairmanship of C. H. Stone, and on tests and analyses of iron oxides by W. A. Dunkley.

A third sub-committee, appointed this year, on cooperative analyses of light oils and tars, Dr. J. M. Weiss, chairman, did not send out any standard samples because the samples of the other two committees were more than enough to keep the various cooperating laboratories busy. Dr. Weiss' sub-committee has submitted a report on revisions suggested by progress in testing methods since the Gas Chemists' Handbook was last revised.

The complete reports of these sub-committees are given as appendices of this report. Special attention is called to the valuable work of the sub-committee on ammonia methods. With no precedent to guide them, Mr. Stone and his committee worked out the difficult details of preparing and shipping these standards so that they reached the cooperating laboratories in good condition. The Chemical Committee is greatly indebted to them for the no small amount of time and labor they devoted to this task.

The results of the analyses and the criticisms of the cooperating laboratories show that the ammonia chapter of the handbook needs extended revision, and the sub-committee has been requested to prepare and present with their report a complete revision of the ammonia chapter.

Mr. Dunkley's committee sent out eight samples of oxides, four used and four unused, to ten different laboratories. Results were obtained from eight laboratories. The comparative tests showed that certain modifications of the methods of the handbook are needed, and that some of the laboratories did not give adequate attention to important details in carrying out the methods, due, perhaps, to the infrequency of using these tests. The sub-committee recommends more work on revising these methods and on educating the laboratories to more careful analytical work.

The sub-committee on Testing and Valuation of Gas Oils, C. A. Lunn, chair-

man, has continued its work from last year on (1) studying laboratory gasification apparatus wherein gas oil is subjected to cracking in an atmosphere of blue gas under controlled conditions and resultant products measured; (2) Has cooperated with the A. S. T. M. in the formulation of standard methods for testing gas oils. Cooperative tests on three samples of petroleum by five gas company laboratories have shown that the results obtained with laboratory gasification apparatus are subject to wide variations, although it appears that the individual companies obtained results of relative value on their own machines.

The sub-committee recommends further study of standardization of laboratory gasification apparatus. The cooperative work with Sub-committee D-2 on Petroleum Products and Lubricants of the American Society for Testing Materials has resulted in the adoption of tentative standard methods for testing gas oils. These methods are given in Appendix D of this report.

In closing this brief review of the work of the sub-committees on cooperative analyses, the Chemical Committee desires to strongly emphasize the importance of this work and to urge every member laboratory to take an active part in analyzing these samples and in criticizing the methods. The value of this research is twofold: First, information is obtained on the accuracy and general suitability of the methods, and second, the participating laboratories discover the accuracy or lack of accuracy of the work done in their own laboratory.

Unfinished problems.—It is obviously impossible to complete the problems of each annual chemical committee in the relatively short space of time available between the organization and the date set for the convention reports. The more important problems require continuous work through several years to accomplish results of value to the industry. It is therefore recommended that the next chemical committee continue work on the following important subjects:

1. Research in cooperation with the U. S. Bureau of Mines on the nature, formation and prevention of gummy deposits in gas pipes and meters should be continued. Much has been accomplished in the past two years and another year should complete the problem.

2. The sub-committee on gas purification should continue research on the correlation of laboratory tests of iron oxide with plant experience; and should report on progress in liquid purification.

3. The testing and improvement of methods of the Gas Chemists' Handbook should be continued until every chapter has been covered so that the next edition may be thoroughly revised in accordance with the best practice. The personnel of the present sub-committee on cooperative analysis of ammonia liquor should be continued and requested to again send out standard samples for testing by the revised methods. The work of the subcommitte on cooperative analysis and testing of iron oxides must also be continued to completion of satisfactory revised methods.

The sub-committee on testing and analysis of light oils and tars should continue with the same personnel if possible and should be requested to prepare and send out standard samples, for tests.

And, finally, the general sub-committee on Revision of The Gas Chemists' Handbook as outlined in the minutes of the Chemical Committee meeting of February 9, 1923, should be reappointed and requested to actively follow up the program of revision.

Appendix A

REPORT OF THE SUB-COMMITTEE ON COOPERATIVE TESTS OF AMMONIA LIQUORS AND MATERIALS

Chapter 2, Part 2, Gas Chemists' Handbook

C. H. Stone, *Chairman,* Rochester, N. Y.

This Committee was appointed on February 9, and on February 15, a proposed plan for cooperative tests of ammonia methods was sent to each member of the sub-committee and to the Chairman of the Chemical Committee for their approval or criticisms. This plan seemed satisfactory to all concerned. A very careful scheme of sampling was worked out whereby it was hoped that all the samples would be absolutely uniform. On March 30, Prof. Wilson and the writer supervised the taking of these samples at the works of the Rochester Gas and Electric Corp. This applies to all except the samples of sulphate which were sent here in bulk by Prof. Wilson and sampled here. Every one of the samples was analyzed before leaving the laboratory and no sample was sent out which varied from the others by more than the limits of experimental error.

Meanwhile, on March 20, a letter was sent to a number of gas companies and others interested in the ammonia business, asking for their cooperation. A total of fifteen laboratories finally agreed to analyze the samples and the names of these are as follows: Henry Bower Chemical Co., Consolidated Laboratories of N. Y., Camden Coke Co., Laclede Gas Light Co., Stillwell and Gladding, Chicago By-Product Coke Co., Clairton By-Product Coke Works, United Gas Improvement Co., C. H. Tenney & Co., Rochester Gas and Electric Corporation, Milwaukee Gas Light Co., Bureau of Mines, Seaboard By-Product Coke Co., Solvay Process Co., and New Haven Gas Light Co. On May 1, the samples were shipped to the participating companies. The delay between sampling and shipment was due to the large amount of time necessary for analyzing each of the ninety samples. A letter accompanying the shipment requested that the methods in the Gas Chemists' Handbook be strictly followed but that any methods of their own be also tried and the methods and results reported. A small bottle of standard acid accompanied each shipment whereby the analyst could check his own acid. All results were to be reported in terms of the standard furnished, and thus no errors due to standardizing the acid could be attributed to the methods in the handbook. The results of these analyses did not come in as rapidly as expected and on May 2, each of the delinquent companies was sent a letter stating that if their results were not received by July 14, we would not be able to enter them in the report. In spite of this, four companies have as yet furnished no results and two companies only partial results.

RESULTS OF COOPERATIVE TESTS ON AMMONIA METHODS

Company Number	*How Calculated*	2	3	4	5	6	8	9	10	12	13	15
Strong Liquor: CO_2	A	N. G.	N. G.		N. G.	N. G.		N. G.	N. G.			N. G.
Specific gravity		1.108	1.107	1.106	1.085	1.105	1.105	1.110				1.1055
Total NH_3	C	22.59	†22.42	†22.62	22.68	†22.69	22.41	23.06	22.13	22.53		22.47
Free NH_3	C	22.31	†22.25	†22.26	22.32	†22.23	22.13	22.48	21.86	22.04		22.20
Sulphides	A	59.5	50.65	54.40	50.5	52.36	57.1	54.4	55.76			55.3
Organic		N. G.	N. G.	N. G.	N. G.	N. G.	93400	‡19600	‡21080			103300
Pyridine	A	1.98	4.8	2.50	2.55	0.42	1.33	2.52	3.12	1.23		2.79
Weak Liquor: Chlorides	A				3.266	†2.81	3.09		3.13			3.02
Total NH_3	A	16.44	15.25	16.30	16.348	16.22	16.53	16.46	16.22	16.18	17.0	16 25
Free NH_3	A	14.27	13.16	13.92	13.922	13.85	14.17 §0.14	14.20	13.35	13.56	15.3	N. G.
Still Waste: Lime	A	0.033	0.328	0.354	0.3564	0.21	0.30	0.32	0.305	0.36		0.34
Total NH_4	A	0.096	0.070	0.138	0.0960	0.93	0.13	0.13	0.0578	0.068		0.079
Sulphate: Pyridine	B	0.46	0.67	0.40	1.28	0.58	0.5	0.32	0.616	0.60		1.05
Ammonia	B	250.8	250.2	252.95	253 88	251.8	250.7	256.6	248.9	251.6		252.3
Organic Number		2293	5880	2800	2400	1400	6400	3540	2910	2390		2500
Moisture	C	0.62	*0.54	*0.54	0.407	0.36	0.50	0.40	0.401	0.34		0.36
Ignited at 100° C.		0.88	0.97	0.87	0.9758	0.87	0.87	0.41	0.874	0.89		0.85
Insoluble residue	C	0.05	0.07	0.07	0.0995	0.06	0.06	0.024	0.072	0.07		0.05
Free acid	B	5.02	6.25	6.37	6.7	0.76	5.7		6.005	6.00		6.20
Cyanides		none			none	none	trace	none		none		none
Crude H_2SO_4: Arsenic	A	none	2.00	trace	none	0.03	0.017	0.79	0.041			0.03
Acid content	C	92.93	93.80	93.72	93.1	93.59	93.51	92.86	93.9	93.40		93.53
Specific gravity		1.8486	1.836	1.8358	1.83	1.8387	1.836	1.840	1.835	1.8376		1.8351
Lime. Active Lime Method a	C	72.73	72.91	73.84	75.5	72.16	73.57	73.90	72.6	72.5		72.57
Method b	C	71.79	67.90	71.90	63.5	71.53	71.16	71.25		65.6		68.3
Method c	C		67.46	71.75	69.7	67.19	68.93	70.11		68.4		67.7
Method d	C							68.90		68.5		68.4
Residue	C	0.13	0.094	0.10	0.11	0.1	0.12	0.11	0.134	0.11		0.17
Magnesia MgO	C	0.62	3.20	0.24	10.57	0.46	0.85	trace	0.73	0.51		0.07

Method (a) distillation (b) direct titration (c) sugar method (d) NH_4Cl method.
A = Grams per liter B = grams per kilogram C = per cent § by direct titration.
* Includes pyridine † Their own method, only one reported ‡ H_2S removed.

The results received at the time of preparing this report (July 12) are given in the table.

Commenting on the results it should be stated that after they were filed, it was learned that a number of the companies did not follow strictly the methods as given in the handbook. This was partly because the procedure as given was impossible to carry out, partly because if carried out the results would be so evidently wrong and partly because the laboratory in question distinctly disapproved of either apparatus or method. This somewhat vitiates the results which we hoped to obtain since this investigation was a study of the methods in the handbook and not of the ability of the different laboratories to determine the actual amounts of the various substances in the samples furnished. However, it is very plain that the methods are in dire need of revision and at the meeting of the Chemical Committee at Atlantic City in June, it was voted that the criticisms of these methods should be sent to every member of the Chemical Committee and that the chapter should be rewritten by the present Sub-Committee and submitted to the entire Chemical Committee for their approval. These criticisms together with the blue prints of the results leave if possible by mail within a week. As soon as the members have been heard from as to their attitude toward these, the rewriting of the chapter will be started and completed if possible, in time to submit to the Chemical Committee before the annual meeting.

Appendix B

REPORT OF SUB-COMMITTEE ON COOPERATIVE ANALYSES AND TESTS OF LIGHT OILS AND TARS

Chapter 2, Parts 3 and 4, Gas Chemists' Handbook

J. M. Weiss, *Chairman,* New York, N. Y.

Your sub-committee makes the following recommendations:

Part 3

1. On page 250 add at the end of the first paragraph "If it is necessary to warm the first two bottles, two additional bottles should be added at the end of the train."

2. We recommend the substitution of the DuPont still for the Laclede still in the evaluation of light oil for benzol and toluol (page 277) as we believe better fractioning will be obtained.

3. On page 276 we suggest adding "The inside tube of the condenser shall be ½" internal diameter brass or copper pipe and shall have at least 60" of its length surrounded by a cooling jacket." This is to insure complete condensation.

4. The sulphonation test for light oil should be added.

5. The committee is uncertain whether the solidifying point test for benzene should be included and asks the advice of the general committee on this point.

6. We think the part should be re-arranged in more logical order and the tests numbered as in part 4.

Part 4

7. We recommend the addition of the Dean and Stark water in tar test (A.S.T.M.D.—23T) as an alternate to present Test 1.

8. Test 19 both text and drawing should be revised according to new Barrett drawing which is more accurate.

9. Test 24 should be revised to correspond with the new float test (A.S.T.M. D.—23T). The old float has given considerable trouble in practice.

10. On page 319, line 3 in test 25, the range 200-250°C. should be 300-390°C.

11. On page 300 make the heading read "Middle and Heavy Oils" instead of "Creosote Oil."

12. Add to this section (Middle and Heavy Oils) the following:

(a) Crude Naphthalene.
(b) Coke test.
(c) Consistency of distillation residue.

Future Work

We recommend that during 1924 cooperative work be undertaken on Part 4 to include full tests of the following:

(a) Crude high carbon tar.
(b) Crude low carbon tar.
(c) Refined tar.
(d) Soft pitch.
(e) Hard pitch.
(f) Middle oil.
(g) Heavy oil.

Appendix C

REPORT OF CHEMICAL SUB-COMMITTEE ON COOPERATIVE TESTS OF PURIFYING OXIDES, ACCORDING TO METHODS OF GAS CHEMISTS' HANDBOOK

W. A. DUNKLEY, *Chairman,* Memphis, Tenn.

AT A MEETING of the Chemical and Purification Committees of the A. G. A. at Association Headquarters, in New York, in February, it was decided to have the methods of the Gas Chemists' Handbook checked up by comparative analyses of various materials, carried out by several laboratories. Among the several subcommittees appointed to handle various departments of this work, was one to collect information relative to the accuracy and convenience of the prescribed methods for testing purifying oxides. The following is a report of this sub-committee:

In March, several samples of purifying oxides were collected at the laboratory of the Peoples Gas Light & Coke Co. in Chicago. These samples were selected with a view to supplying oxides for test which were typical of the various kinds of oxide in practical use. Accordingly the samples selected included fresh materials, which were numbered serially as follows:

1. A mine water oxide produced by the precipitation of iron oxide from iron bearing mine water, by finely ground calcium carbonate.

6. A borings oxide made by water rusting iron borings.

7. A natural ore oxide.

8. A by-product oxide residue from the treatment of bauxite in the aluminum industry.

The following used oxides were also selected:

2. An oxide which had been used for purifying coal gas, dried and ground.

3. A water gas oxide similarly prepared.

4. A coal gas oxide, same material as sample No. 2 but without drying or grinding.

5. Water gas oxide same as No. 3 but without drying or grinding.

Preparation of Samples

The fresh oxides were ground in a power-driven mill to disintegrate all lumps and faciliate the taking of a series of uniform samples. There was no preliminary drying except sufficient air drying to permit the material to be ground easily. After grinding, the oxide was thoroughly mixed before sampling. Fresh oxides were shipped to the various laboratories in metal cans equipped with screw covers and rubber gaskets, (the regular coal sample cans used by the U. S. Bureau of Mines for shipping coal samples).

The sulphided materials (water gas and coal gas oxides) were each divided

into two portions. One portion was dried in metal trays on top of a steam radiator, being stirred occasionally. This drying was continued until the materials had lost sufficient oil and water vapors so that they had become sufficiently brittle to be ground. The grinding was sufficiently fine so 85 to 90 per cent would pass a 30-mesh screen. This was as fine grinding as the facilities available seemed to permit.

After grinding, the samples were thoroughly mixed and the small samples taken. One portion of each of the original foul oxide samples was left in a moist and unground state in order that it might be possible to compare the treatment of such samples by various laboratories. While the difficulty of sampling such coarse materials was appreciated, an effort was made to make all of the small samples alike, so far as could be judged from inspection. The foul oxides were shipped by express in sealed glass fruit jars.

Laboratories Supplied with Samples

Samples were shipped to the following companies or institutions:

Consolidated Gas Co. of New York.
Consolidated Gas Co. of Boston, Mass.
United States Improvement Co., Philadelphia, Penn.
Rockford Gas Light Co., Rockford, Ill.
Rochester Gas & Electric Corporation, Rochester, N. Y.
The Chemical Service Laboratories, West Conshohocken, Pa.
The Koppers Co., Pittsburgh, Pa.
Memphis Power & Light Co., Memphis, Tenn.
U. S. Bureau of Mines, Pittsburgh, Pa.
Peoples Gas Light & Coke Co., Chicago, Ill.

In the tabulation of results given later, the various laboratories are designated by letters,—A, B, C, etc., but not in the same order as given above. At the time of this report, results had been received from eight of the ten laboratories listed. Therefore, the report cannot be complete but a sufficient number of reports have been received to give rather definite conclusions as to the reproducibility of results by the methods used and to suggest some improvements in the methods.

Instructions Sent to Laboratories

At about the time of shipment of samples to the various laboratories, a letter of instruction was sent out by the Chairman of the Sub-Committee as follows:

"It is the desire of the committee that these samples be handled and analyzed according to the methods of the Gas Chemists' Handbook, pages 96 - 109, making one fouling of each of the fresh samples as discussed in the text, in addition to the regular chemical analyses as described. No foulings would be made with the used materials, merely the chemical analyses as described in the text.

"So far as can be assured by careful sampling at the laboratory of the Peoples Gas Light & Coke Co., Chicago, when these samples were prepared, the samples which you will receive are the same in composition as the samples sent to all the other laboratories. In order that the analytical results reported may be an index to the accuracy of the methods of the handbook, the determination of which is the purpose of these comparative tests, it is earnestly requested that every precaution be taken in sampling these samples for analysis, to have the small portions be truly representative of the samples from which they were taken and that the methods of the handbook be followed as exactly as possible.

"If, as is altogether possible, you find that the methods, even when followed carefully, permit of considerable variation, comments to this effect to the Chairman of the Sub-Committee will be wel-

comed. We realize that the methods may be imperfect and the purpose of the comparative tests is to improve them where possible, so comments and suggestions will be considered very valuable."

Results Reported

For convenience in comparison, the several determinations such as moisture, Fe_2O_3, free iron, etc., are tabulated separately.

MOISTURE—EXPRESSED IN PERCENTAGE IN EACH CASE

Laboratory	Sample Numbers 1	2	3	4	5	6	7	8
A	20.50	0.00	1.00	24.10	20.60	4.10	13.60	17.70
B	23.45	1.20	3.66	24.71	23.25	4.46	14.41	
C	26.74	1.79	3.19	23.77	21.72	5.81	14.81	21.23
D	24.18		2.80	23.85	21.18	5.13	14.08	
E	25.90	1.60	3.50	23.80	21.40	4.90	13.80	17.90
F		1.09	2.90	24.29	27.04			
G	27.40	0.50	1.00	23.90	18.50	3.70	14.70	
H	26.00	2.00	3.50	24.50	25.00	15.50*	14.00	21.00

*Sample received with can cover loose. Sample evidently absorbed moisture.

METALLIC IRON—PERCENT—DRY BASIS

Laboratory	Sample Numbers 1	2	3	4	5	6	7	8
A	13.33					5.80	1.78	10.19
B	11.98					11.25	0.42	
C	7.07					3.40	0.57	12.08
D	0.00					7.11		
E								
F								
G	Not determined					8.2	Not determined	
H	2.99					7.47	1.33	1.36

FERRIC OXIDE—PERCENT—DRY BASIS

Laboratory	Sample Numbers 1	2	3	4	5	6	7	8
A	11.48					57.68	54.86	29.24
B	16.39					55.78	58.75	
C	24.87					68.73	61.23	29.22
D	32.82					58.17	59.07	37.24
E	35.10					66.35	59.16	43.48
F								
G	35.20					67.00	54.30	
H	36.11					65.63	53.64	64.53

LIME—AS $Ca(OH)_2$ DRY BASIS

Laboratory	Sample Numbers 1	2	3	4	5	6	7	8
A	18.29					1.55	1.35	8.74
B	22.62					1.16	1.64	
C	18.77					.87	.87	7.33
D	15.72					.78	.41	5.96
E								
F								
G	16.3					0.9	0.9	
H	20.01					1.36	1.26	.90

TOTAL SULPHUR—DRY BASIS—PERCENT

Laboratory	Sample Numbers 1	2	3	4	5	6	7	8
A		35.73	34.60	35.44	35.81			
B		35.08	38.58	35.46	32.82			
C		36.49	39.20	35.50	33.73			
D		36.35	37.70	34.70	32.90			
E		40.11	39.33	41.32	37.62			
F		35.03	40.10	37.58	32.22			
G		34.60	36.86	34.30	30.40			
H		33.91	38.75	35.62	31.65			

TARRY MATTER—DRY BASIS—PERCENT

Laboratory	Sample Numbers 1	2	3	4	5	6	7	8
A		1.37	9.33	0.11	0.19			
B		4.29	8.80	0.85	11.61			
C		0.00	5.68	0.00	6.27			
D		10.40	10.97	9.2	9.30			
E		4.90	17.83	4.79	12.27			
F		Trace	4.15	4.82	8.76			
G		17.2	24.30	9.2	25.6			
H		6.6	11.38	15.26	10.18			

SOLUBLE SULPHUR

Laboratory	Sample Numbers 1	2	3	4	5	6	7	8
A		34.42	33.33	34.19	35.38			
B		33.41	33.63	32.34	27.72			
C		36.49	36.48	34.95	29.29			
D		27.64	25.78	29.15	24.20			
E		26.91	33.09	35.80	30.03			
F		21.59	31.62	28.50	28.72			
G		18.60	19.70	24.50	12.30			
H		10.33	24.36	9.85	8.28			

FOULING TEST—PERCENT H_2S DECOMPOSED IN ONE FOULING

Laboratory	Sample Numbers 1	2	3	4	5	6	7	8
A	19.56					7.69	36.82	23.32
B	16.70					26.60	34.00	
C	16.69					7.99	26.83	15.22
D	15.62					13.41	37.36	19.68
E	16.49					8.93	28.23	18.63
F								
G	21.10					12 20	37.60	
H	22.68					11.84	36.85	39.27

The foregoing results of analyses indicate the greater reliability of certain tests as compared with others. They also show that certain tests permit of very wide variation in results. This indicates which determinations need radical revision of methods. The comments of the various chemists participating in the com-

parative tests, are especially valuable and taken in conjunction with the reported results should do much toward the adoption of improved methods or the revision of those already prescribed in the Gas Chemists' Handbook.

COMMENTS FROM THE VARIOUS LABORATORIES

Moisture Determination

There was little comment on this method. As shown by the table the moisture results reported by the various laboratories agreed fairly closely. In one case, as noted by Laboratory H, sample was received in a can with a loose cover and the moisture was very much higher than reported by any other laboratory, for this particular sample. This is in line with the comment of Laboratory G,—"When oxide is perfectly dry it must be remembered that it will absorb moisture rapidly from the air; accordingly, it should be exposed as little as possible. This is especially important in grinding. If it is desired to overcome this source of error, the oxide might be air dried at room temperature, and all estimations and tests (including another moisture determination) should be made on the air-dry sample."

It seems likely that the relatively small differences in moisture as reported were probably due to the duration of exposure, humidity, temperature, etc., in the various laboratories in which samples were analyzed. The hygroscopic property of iron oxides is well known.

Free Iron

Of all the methods applying to oxides prescribed in the Gas Chemists' Hand-Book, the determination of free iron is one of the most uncertain and unsatisfactory. This is readily observed from the inspection of the tabulated results given above. Some laboratories reported free iron in every sample submitted. Others did not analyze certain samples for free iron because the materials were evidently natural or precipitated oxides and, therefore, would not be expected to contain this constituent. The comments with reference to this determination are as follows:

Laboratory C states—"We have no confidence in the method for the determination of metallic iron."

Laboratory G—"Our experience with this method has not been satisfactory."

The wide range of results actually reported indicate quite conclusively that there is too much opportunity for variation in the use of the method to class it as an exact determination.

Ferric Oxide

The determination of ferric oxide has been worked out to such a degree of refinement in the iron and steel industry where thousands of tons of ore are bought on analysis, that there would seem to be little opportunity for wide variation in the analytical results obtained when determining this constituent. The tabulated results given above are, therefore, rather surprising. In the analysis of oxide sample No. 1 is this variation especially noticeable, the Fe_2O_3 content reported varying from 11.48% to 36.11%. It appears that a typographical error in the Handbook may have been responsible for part of the error. The comments received on this method are as follows:

Laboratory A—"The A. G. A. Handbook, page 101, 4th line from top, says 'Add 600 cc Mercuric chloride solution.' In our work 60 cc was assumed to be the quantity intended, and on the 14th line,

same page, it says, 'Multiplied by 200 gives the per cent.' We think it should read, 'multiplied by 100' and have been so guided."

Laboratory B calls attention to the same apparent errors. This laboratory used 30 cc mercuric chloride instead of 600 cc as prescribed in the Handbook.

Laboratory C makes no comment on this point but states—"We think that the volumetric method for the determination of ferric oxide, which is the principal one, is made too circumstantial for those laboratories, which infrequently have to make this determination and each time would have to prepare and test the standard solution. It seems preferable to make a gravimetric determination."

Laboratory E calls attention to the typographical errors referred to above and further suggests that the methods for iron determinations seem too long for industrial laboratory work.

Laboratory G states—"We made determinations of the ferric oxide in these samples by a slightly different method, namely:

"After the addition of the 200 cc of hydrochloric acid, the sample is digested thoroughly on the steam bath and the solution filtered. This filtrate is diluted to known volume, and an amount representing 1 gram of sample taken. This is evaporated to low bulk in a 500 cc Erlenmeyer flask, with the frequent addition of small amounts of potassium chlorate, being careful to expel the last traces of chlorine after the last addition. The solution is then treated with stannous chloride, and the procedure is exactly the same as that given on page 101. The results obtained by this method compare as closely with the results obtained with the method given in the Gas Chemists' Handbook, as did duplicate determinations of the iron oxide by the latter method.

Lime Determination

No comments were made by any of the laboratories relative to this method. Not all of the laboratories determined lime in the samples submitted. In general, the results obtained for this constituent were fairly close, though in cases where the lime content was very low (less than 2%) the results reported by some laboratories were 4 times as much as the amounts reported by other laboratories. Just where the difficulty lies is not apparent but it seems likely that the lime determination is so seldom made by some laboratories that their analysts do not have sufficient practice in the technique of this operation.

Fouling Test

The testing of oxides by fouling with H_2S, the way in which such a test should be conducted and the value of the results obtained in valuing an oxide, have received so much attention from the Purification Committee of the A. G. A. and so much has been written for and against particular methods, that the value of the method prescribed in the Handbook is an open question. The tabulation of results given above indicates the possibility of obtaining widely different results in different laboratories,—yet it must be admitted that the variation is no greater than in the case of some thoroughly standard determinations such as ferric oxide and lime.

The following comments were made relative to the test:

Laboratory A—"In making the fouling tests, the Handbook is not clear as to whether the dried or undried material should be used. We have assumed it to

mean the undried material. Five grams of samples 1, 7 and 8 were used for fouling tests, while No. 6, being a prepared oxide, 100 grams were used."

Laboratory C—"In regard to sulphiding a sample, we followed the instructions but we still prefer a method taking a larger sample,—say 4 ounces, and thoroughly saturating it, extracting the sulphur."

Laboratory G—"We have found that a more convenient form of tube than the U-tube for containing the oxide, is a cylindrical tube 13 c. m. long and 2.5 c. m. in diameter (with stoppered ends?) and with two tubulures blown in the sides of the tube near the ends (in the manner of the jacket of an ordinary Liebig condenser). Approximately 3.5 grams of sawdust were used, instead of 2 grams. The fouling test of sample No. 6 was made on a sample of 203 grams in a large jar, as given on page 104. We consider the results obtained by this procedure as being unsatisfactory. Oxides 1 and 7 were moistened in the tube by air aspirated through fouling water."

Total Sulphur

In the determination of total sulphur in foul oxides, the agreement was better than in the case of any other constituent. In most cases the gravimetric method was employed. Some laboratories did the gravimetric, volumetric and alternate methods and some comments relative to the relative desirability of these methods were made.

Following is a tabulation of results obtained by the three methods in cases where all three methods were applied:

Laboratory D

Sample No.	*2*	*3*	*4*	*5*
Gravimetric	36.35	37.70	34.70	32.90
Volumetric	31.40	27.70	26.57	29.60
Alternate	34.20	34.50	32.40	28.80

Laboratory F

Sample No.	*2*	*3*	*4*	*5*
Gravimetric	35.03	40.10	37.58	32.22
Volumetric	39.42	37.52	38.96	35.87
Alternate	34.90	36.90	37.41	32.47

Comments

Laboratory D stated that while the results were reported as above, any figure could be obtained by the volumetric method.

Laboratory F comments on the methods as follows:

"With the volumetric method, end point is very unsatisfactory. The writer has never had any degree of success using this method with any sulphide, sulphite or sulphate, containing a high percentage of iron. This method is quite satisfactory for determination of sulphur in coal or total sulphur in gas. Further work should be done with this method to make it successful for it is the shortest method found in the book. Precipitations as barium sulphate are very satisfactory if a proper fusion of the sample is obtained. It is recommended that this method be revised as follows:

"One-half gram of oxide to be weighed into the fusion cup of a Parr heat ignition bomb with 2 grams of potassium chlorate, 10 grams sodium peroxide, and 1 gram benzoic acid. The addition of this benzoic acid insures complete fusion. We have found that when using sodium peroxide and potassium chlorate the oxide will not fuse properly unless some material high in carbon is added. The method, oxidizing with nitric acid seems to give the most reliable results, but is too long and tedious for quick routine work. In our estimation, a combination of the fusion method using benzoic acid and the titration with sodium thio sulphate is the best and quickest method if some of the minor difficulties can be removed."

Soluble Sulphur

The tabulation of the results for soluble sulphur show that certain laboratories obtain much lower results, rather consistently, on all samples than do other laboratories. Some laboratories do not state just what form of apparatus was used. Others used methods differing somewhat from those in the Handbook.

Comments

Laboratory A uses a Soxhlet extractor connected to a reflex condenser and catches the extract in a weighed 8-oz. CO_2 flask containing about 75 cc of freshly distilled CS_2. Extraction is continued about 3 hours or until CS_2 syphoning back is colorless. CS_2 is then distilled out of flask and later to constant weight at a temperature not exceeding 100°F. Sulphur is oxidized by 20 cc red fuming CP nitric acid and about 0.3 grams $KClO_3$, gently heating until all sulphur is in solution and tarry matter oxidized. Add HCl, continue boiling until all HNO_3 is expelled, make up to 500 cc. Precipitate 50 cc with BA Cl_2 and determine sulphur in regular way.

Laboratory F does not approve of the extraction method as an accurate test. They state—"Both carbon disulphide and carbon tetrachloride are rather inaccurate and unreliable and serve only as an approximate test."

Laboratory G extracts with carbon tetrachloride using an alundum thimble 3 x 8 c. m., and the apparatus given by Weiss (Jour. Ind. & Eng. Chem., Vol. 10, No. 9, page 732) for the determination of free carbon in crude tar. A low flame is used instead of a water bath.

Tarry Matter

This method is very unsatisfactory and unreliable, judging by the results reported. See Tabulation. Practically no comments on the method were made by any of the participating laboratories.

Conclusions

The comparative tests show conclusively that certain modifications of the methods of the Handbook, applying to oxides are needed. The variety of results obtained may be attributed to the following possible conditions:

1. Lack of uniformity of samples, due to method of preparing and shipping samples.
2. Uncertainty of testing methods employed.
3. Errors in laboratory tests or in calculations.

Each of these conditions is likely to enter, to a certain degree, in all determinations. For example, even with every possible precaution, certain oxides, especially those containing iron borings and shavings, are difficult to sample. We believe that the samples for this comparative test were taken as carefully as possible.

From the comments of the various laboratories, we note a feeling of dissatisfaction with certain of the methods. They were not sufficiently clear cut to give a feeling of assurance. The tests for metallic iron, free sulphur, tarry matter and fouling, especially, seem to need improvement.

In view of the more or less standardized state of such determinations, as calcium, ferric oxide, and total sulphur, it seems that variations in the results obtained from these determinations are likely due, to a certain extent, to the infrequency of applying these tests in some laboratories, or lack of attention to the

minute details when using the methods.

Your sub-committee recommends that a committee be appointed for the coming year to study the methods which need revision with a view of discovering the weaknesses of these methods and substituting other methods if such methods can be devised.

Appendix D

REPORT OF SUB-COMMITTEE ON TESTING AND VALUATION OF GAS OILS

CHAS. A. LUNN, *Chairman*, New York, N. Y.

THE SUB-COMMITTEE has directed its efforts along the following lines:

1st: A study of laboratory gasification apparatus,* wherein gas oil is subjected to cracking in an atmosphere of blue gas under controlled conditions and the resultant products measured.

2: Cooperation with the American Society for Testing Materials for the purpose of formulating standard methods for the testing of gas oils.

Three samples of petroleum were forwarded to five gas companies' laboratories having gasification apparatus with the request that these be tested in accordance with specified conditions with the gasification apparatus at hand. It was the purpose of these tests to determine what degree of concordance might be obtained with apparatus varying in design. The results of these tests showed very wide variations among the several investigators and it is the opinion of your Committee that before this test can be standardized a considerable amount of study must be given to both the design and operation of the apparatus. Each of the companies equipped with laboratory gasification apparatus reports that it is of considerable assistance in determining the relative gas making value of gas oils and it seems probable that the variations found in this series of tests may be attributed to the fact that each laboratory gasification apparatus has been designed and is operated to give results comparable with the particular company's works operation, which would be affected by local standards of quality for gas, type of gas making machine and a number of other variables. Your committee recognizes the desirability of obtaining more direct measurement of the relative gas making value of gas oils than is furnished by the usual laboratory tests and believes that further study should be directed towards standardizing the laboratory gasification apparatus.

This committee has cooperated actively with a Subcommittee of Committee D-2 on Petroleum Products and Lubricants of the American Society for Testing Materials during the past two years, in studying methods of testing gas oils. As a result of this cooperation proposed methods of testing gas oils were presented to the society at its last annual meeting and were adopted as Tentative Standard. Copy of "Tentative Methods of Testing Gas Oils" of the American Society for Testing

*Gas Chemists' Handbook, Second Edition, page 66.

Materials is appended hereto. For those who are not familiar with the by-laws of the American Society for Testing Materials, it is worthy of mention that at least one year must elapse before a "Tentative Standard" can be voted upon for adoption as "Standard" and during this period criticisms of the Tentative Standard are invited. It is therefore important that gas companies consuming gas oils give careful study to these Tentative Methods during the ensuing year and submit their criticisms to the Chairman of this Subcommittee, in order that they may receive careful consideration before the methods are presented for adoption as Standard.

American Society for Testing Materials

TENTATIVE METHODS OF TESTING GAS OILS

(GRAVITY, DISTILLATION, SULFUR, CARBON RESIDUE, POUR POINT, VISCOSITY, WATER)[1]

Serial Designation: D 158—23 T

This is a Tentative Standard only, published for the purpose of eliciting criticism and suggestions. It is not a Standard of the Society and is subject to revision. (Issued, 1923.)

Gravity

1. The gravity shall be determined at 60°/60° F. (15.6°/15.66° C.) in a pyknometer, accurately standardized, or by means of a hydrometer or Westphal balance, the accuracy of which has been verified The gravity shall be recorded as specific gravity or gravity, degrees A.P.I., at 60°/60° F. (15.6°/15.6° C.).

Distillation

Apparatus

2. *Flask.*—The distillation flask shall be a Saybolt distilling flask, the dimensions and permissible variations being as follows:

	Centimeters	Tolerances Inches	Tolerances Cm.
Diameter of bulb, outside	8.57	3.37	0.3
Diameter of neck, inside	1.50	0.59	0.1
Over all length, neck plus bulb	21.50	8.46	0.3
Length of vapor tube	17.50	6.89	0.5
Diameter of vapor tube, outside	0.60	0.24	0.05
Diameter of vapor tube, inside	0.40	0.16	0.05
Thickness of vapor tube wall	0.10	0.04	0.02

The center of the vapor tube shall be 6.5 cm. (2.56 in.), ±0.3 cm., below the top of the neck. The tube is approximately in the middle of the neck and set at an angle of 75 deg., ±3 deg., with the vertical.

3. *Condenser.*— The condenser[2] shall consist of a 9/16 in. (14.29-mm.), outside diameter, No. 20 Stubbs Gage seamless brass tube, 22 in. (55.88 cm.) in length. It shall be set at an angle of 75 deg. with the vertical and shall be sur-

[1]Criticisms of this Tentative Method are solicited and should be directed to Mr. Van H. Manning, Secretary of Committee D-2 on Petroleum Products and Lubricants, 15 W. Forty-fourth St., New York City.

[2]A condenser conforming to these specifications is illustrated in the Tentative Method of Test for Distillation of Gasoline, Naphtha, Kerosene and Similar Petroleum Products (Serial Designation: D 86-23 T) of the American Society for Testing Materials.

rounded with a bath 15 in. (38.1 cm.) in length, approximately 4 in. (10.16 cm.) in width by 6 in. (15.24 cm.) in height. The bath shall be provided with suitable connections for circulating water through it. The lower end of the condenser tube shall be cut off at an acute angle, and curved downward for a length of 3 in. (7.62 cm.) and slightly backward so as to insure contact with the wall of the receiving graduate at a point approximately 1 to 1¼ in. (2.54 to 3.18 cm.) below the top of the graduate when it is in position to receive the distillate.

4. *Shield.*—The shield[1] shall be made of approximately No. 22 gage sheet metal and shall be 19 in. (48.26 cm.) in height, 11 in. (27.94 cm.) in length and 8 in. (20.32 cm.) in width, with a door on one narrow side, with two openings, 1 inch (2.54 cm.) in diameter, equally spaced, in each of the two narrow sides, and with a slot cut in one side for the vapor tube. The centers of these four openings shall be 8½ in. (21.59 cm.) below the top of the shield. There shall also be three ½-in. (1.27 cm.) holes in each of the four sides with their centers 1 in. (2.54 cm.) above the base of the shield.

5. *Ring Support and Hard Asbestos Boards.*—The ring support may be of the ordinary laboratory type, 4 in. (10.16 cm.) or larger in diameter, and shall be supported on a stand inside the shield. There shall be two hard asbestos boards: One 6 by 6 by ¼ in. (15.24 by 15.24 cm. by 6.35 mm.) with a hole 2¾ in. (6.99 cm.) in diameter in its center, the sides of which shall be perpendicular to the surface; the other, an asbestos board to fit tightly inside the shield, with an opening 4 in. (10.16 cm.) in diameter concentric with the ring support. These shall be arranged as follows: The second asbestos board shall be placed on the ring and the first or smaller asbestos board on top so that it may be moved in accordance with the directions for placing the distilling flask. Direct heat shall be applied to the flask only through the 2¾ in. (6.99 cm.) opening in the first asbestos board.

6. *Gas Burner.*—The burner shall be so constructed that sufficient heat can be obtained to distill the product at the uniform rate specified below. The flame should never be so large that it spreads over a circle of diameter greater than 4½ in. (11.43 cm.) on the under surface of the asbestos board. A sensitive regulating valve and gas pressure governor are desirable adjuncts, as they give complete control of heating.

7. *Thermometer.*—The A.S.T.M. Distillation Thermometer conforming to the requirements specified in Section 6 (*b*) of the Tentative Method of Test for Distillation of Gasoline, Naphtha, Kerosene, and Similar Petroleum Products (Serial Designation: D 86-23 T) of the American Society for Testing Materials[1] shall be used.

8. *Graduates.*—

(*a*) *For Sample.*—A graduate or pipette graduated to deliver 200 cc., ± 1.0 cc., may be used for measuring the sample to be tested.

(*b*) *For Fractions.*—The graduates used for measuring fractions shall be of the cylindrical type, of uniform diameter, with a pressed or molded base and a lipped top. The cylinder shall be graduated to contain 100 cc. and the graduated portion shall be not less than 7 in. (17.78 cm.) nor more than 8 in. (20.32

[1]A shield conforming to these specifications is illustrated in the Tentative Method of Test for Distillation of Gasoline, Naphtha, Kerosene and Similar Petroleum Products (Serial Designation: D 86-23 T) of the American Society for Testing Materials.
[1]See p. 17.

cm.) in length. It shall be graduated in single cubic centimeters and each fifth mark shall be distinguished by a longer line. It shall be numbered from the bottom at intervals of 10 cc. The distance from the 100 cc. mark to the rim shall be not less than 1¼ in. (3.18 cm.) nor more than 1¾ in. (4.45 cm.). The graduations shall not be in error by more than 1 cc. at any point on the scale.

Procedure

9. (*a*) Provision shall be made for circulating water through the condenser.

(*b*) The condenser tube shall be swabbed to remove any liquid remaining from the previous test. A piece of soft, lint-free cloth attached to a cord or copper wire may be used for this purpose.

(*c*) A volume of water-free oil equivalent to 200 cc. at 55 to 65° F. (12.8 to 18.3° C.) shall be placed in the flask.

Note.—The method of dehydrating the oil is optional. In the case of nonviscous oils gravity settling or centrifuging often produce the desired result. More viscous oils can be dehydrated by: (1) Heating with a suitable dehydrating agent in an autoclave up to a temperature not exceeding 392° F. (200° C.). This method is described in detail in U. S. Bureau of Mines **Bulletin No. 207** on the Analytical Distillation of Petroleum and Its Products. (2) Preliminary Distillation. The general procedure is to heat very slowly a mass of oil in a distillation flask fitted with a thermometer and connected to a water-cooled condenser and to play a flame on the neck of the flask in such a manner that it is heated uniformly to a temperature slightly in excess of 212° F. (100° C.). When the water is completely distilled, heating is discontinued and the flask allowed to cool; the thermometer is removed and the distillate, which has been separated from the water, is poured back. The mass of oil is then thoroughly mixed and the test sample withdrawn.

The method of measuring is optional, depending on the viscosity of the product to be tested. The following schemes have been used with satisfactory results:

For non-viscous or moderately viscous oils, measure at room temperature from a graduate or pipette calibrated to deliver 200 cc.

Oils of moderate or high viscosity can be handled in a pipette if suitable precautions are taken. The pipette should not be drawn to a point and the oil may be drawn in by mechanical suction and expelled under air pressure. Drainage can be completed by warming the pipette gently with a luminous gas flame, if care is taken not to ignite the charge of oil nor to boil or carbonize the oil residue in the pipette.

Oils of moderate or high viscosity can often be handled most conveniently by weighing into the tared flask the equivalent of 200 cc. at 60° F. The weight to be used is 200 times the specific gravity of the oil at 60° F.

(*d*) The thermometer, provided with a cork, shall be fitted tightly into the flask so that it will be in the middle of the neck and so that the lower end of the capillary tube is on a level with the inside of the bottom of the vapor outlet tube at its junction with the neck of the flask.

(*e*) The charged flask shall be placed over the 2¾ in. (6.99 cm.) opening in the asbestos board with the vapor outlet tube inserted into the condenser tube. A tight connection may be made by means of a cork through which the vapor tube passes. The position of the flask shall be so adjusted that the vapor tube extends into the condenser tube not less than 1 in. (2.54 cm.) nor more than 2 in. (5.08 cm.).

(*f*) A clean, dry graduated cylinder shall be placed at the outlet of the condenser tube in such position that the condenser tube shall extend into the graduate approximately 1 in. (2.54 cm.) but not below the 100 cc. mark.

10. When everything is in readiness, water shall be circulated through the condenser bath at such a rate that the water overflowing the condenser shall be at a temperature of 90 to 100° F. (32.2 to 37.8° C.). Heat shall be applied to the contents of the flask at a uniform rate, so regulated that the first drop of condensate falls from the condenser in not less than 10 nor more than 15 minutes.

When the first drop falls from the end of the condenser, the reading of the distillation thermometer shall be recorded as the *initial boiling point.* The receiving cylinder shall then be moved so that the end of the condenser tube shall touch the side of the cylinder. The heat shall then be so regulated that the distillation will proceed at a uniform rate of not less than 8 cc. nor more than 10 cc. per minute. A fraction shall be separated at every temperature point above the initial boiling point that is a multiple of 50° F. When the temperature of the distilling vapors reaches 500° F. (260° C.), the temperature of the water in the condenser bath shall be adjusted to approximately 140° F. and the bath maintained between 140 and 160° F. (60 to 71.1° C.) for the remainder of the test. The distillation shall be continued until a vapor temperature of 700° F. (371.1° C.) is reached or until the maximum temperature point is reached. Sufficient time shall be allowed after distillation is discontinued for the condenser to drain into the final fraction.

The maximum temperature point may result from complete distillation of the oil below 700° F. (371.1° C.), or from cracking.

In case the oil distills completely below 700° F. (371.1° C.), the final adjustment of heat shall be made when a quantity of distillate amounting to 90 per cent of the sample has been collected. The heating shall be continued until the mercury reaches a maximum height and starts to fall consistently; but in no cases should the period between the 90 per cent point and the maximum temperature be more than 10 minutes. The highest temperature observed on the distillation thermometer shall be recorded as the *maximum temperature.*

Cracking will be evidenced by an increase in distilling rate with a thermometer reading that may advance very slowly, remain stationary, or recede, and an effort to adjust the distilling rate will usually result in a decided drop in the temperature reading. When this condition is observed, distillation shall be discontinued and the preceding fraction considered as the final fraction.

Each fraction shall be brought to room temperature, the volume read and recorded, and the fraction set aside for the determination of the gravity. The percentage of distillate in each fraction shall be calculated and recorded. The difference between 100 and the sum of the distillates in per cent shall be calculated and recorded as *residue and loss.*

The gravity of each fraction and of the residue shall be determined at or corrected to 60° F. (15.6° C.). The gravity of each fraction shall be recorded as specific gravity or as gravity, degrees A. P. I.

Sulfur

11. The sulfur shall be determined in accordance with the Tentative Method of Test for sulfur in Petroleum Oils Heavier than Illuminating Oil (Serial Designation: D 129-22 T) of the American Society for Testing Materials.[1]

Carbon Residue

12. The carbon residue shall be determined in accordance with the Conradson Method, as described in Sections 3 and 4 of the Standard Methods of Testing Lubricants (Specific Gravity, Free Acid, Carbon Residue, Viscosity) (Serial Designation: D 47) of the American Society for Testing Materials.[1]

[1] *Proceedings*, Am. Soc. Testing Mats., Vol. 22, Part I, p. 777 (1922).
[1] 1921 Book of A.S.T.M. Standards.

Pour Point

13. The pour point shall be determined in accordance with the Tentative Method of Test for Cloud and Pour Points of Petroleum Products (Serial Designation: D 97-23 T) of the American Society for Testing Materials.

Viscosity

14. (*a*) The viscosity of oils showing a time of less than 500 seconds, Saybolt Universal, at 100° F. (37.8° C.), shall be determined on the Saybolt Universal Viscosimeter at 100° F. in accordance with the method described in the Tentative Methods of Test for Viscosity of Petroleum Products and Lubricants (Serial Designation: D 38-23 T) of the American Society for Testing Materials.

(*b*) The viscosity of oils showing a time of over 500 seconds, Saybolt Universal, at 100° F., shall be determined on the Saybolt Furol Viscosimeter at 122° F. (50° C.) in accordance with the Tentative Methods of Test for Viscosity of Petroleum Products and Lubricants (Serial Designation: D 88-23 T) of the American Society for Testing Materials, except that oils showing a time of less than 25 seconds, Saybolt Furol, at 122° F. (50° C.) shall be tested on the Saybolt Universal at 122° F. (50° C.).

Water

15. Water shall be determined in accordance with the Tentative Method of Test for Water in Petroleum Products and Other Bituminous Materials (Serial Designation: D 95-23 T) of the American Society for Testing Materials.

REPORT OF THE COMMITTEE ON DEPOSITS IN GAS PIPES AND METERS

Ralph L. Brown, *Chairman,* Pittsburgh, Pa.

Introduction

The report of the Deposits Committee for 1922 dealt exclusively with the study it had made of gummy and resinous deposits in pipes and meters. It reported that the gummy deposits were due fundamentally to the unsaturated hydrocarbons of the gas. It reported the identification and the measurement of the particular chemical compounds that are gum-forming and which are responsible for gum formation in pipes and meters. It reported, in simple terms, the chemical properties and behavior of the principal compounds—indene and styrane. It proved that the gummy deposits were largely formed from these compounds through polymerization, autoxidation and other chemical action. It pointed out the incontestable evidence proving that the oxygen of the gas plays an important role in gum formation. In addition, the role is an inevitable one, general and second only to the presence of the natural condensate with which it may react. The committee reported many other lesser factors in gum formation, some being by-products and corrosion deposits acting indirectly, others primary constituents of the gas such as H_2S or SO_2, etc. The latter are specific and not general because a number of plants in which entire normalcy of operation was maintained have experienced gummy deposits in various degrees of severity. Naturally, where gas practically unpurified passed for an extended period into the distributing system in which all the factors mentioned above were operating at a maximum, sulfur in its various forms functioned heavily as stated in the report of this committee for 1921.

The formation of gummy deposits by any gas is dependent primarily on the quantity and composition of the light oil it carries. This latter has its pyrogenetic origin in the gas oil used and in the chemical and physical changes effected in it in the carburetting process. Control of the quantity and composition of the light oil, carried by the gas into distributing systems, is vested in three gross major factors. These are, first, the oil used in carburetting the blue gas, second, the process of carburetting, and lastly, the purification processes. These latter included the cooling, condensing, the removal of tar and

other impurities of the gas. A fourth general factor entering into gum formation is the oxygen content of the gas and the control of this is obviously to be found in the operation of the purifiers. A general discussion of these major factors appeared in the May issue of the A. G. A. *Monthly* and they need not be taken up again here.

The program of work of the Deposits Committee for this year—1923—was based on the four major factors just mentioned. Material ready for presentation will be presented under the following titles:

I. Oil.—The relation of the character of the gas oil to the composition and gum-forming constituents of the light oil of the resultant gas.

II. Carburetion.—Light oil composition as found in carburetted water gas.

III. Purification.—A report on the actual oxygen consumption by purifier boxes, where revivification *in situ* is employed.

I. Gas Oil

The relation of the character of the gas oil to the character of the light oil and to the amount of gum-forming constituents in the gas has been investigated by Mr. E. F. Pohlman, the writer and Mr. H. G. Berger* through the courtesy of the Peoples Gas Light and Coke Company of Chicago, and the U. S. Bureau of Mines.

The plan of investigation was to crack samples of different types of gas oil under strictly comparable conditions and to determine the quantity and composition of the light oil in the resulting gas. The entire experimental detail of the investigation can not be included in this brief report and will be published separately. For the present purpose, it will suffice to say that three gas oils in common use—two grades of Mid-Continent, and a California oil—were cracked in an atmosphere of blue gas in the apparatus developed by Pohlman and his associates some years ago and used generally since. The apparatus was fitted with condensing coils maintained at -20° C. and a wash oil scrubber of the usual design for the recovery of the light oil. The recovery was quite complete since about 50% of the light oil was recovered as condensate and the remainder caused an enrichment of the wash oil of only about 1.5 to 2.3%. The apparatus, cracking procedure, light oil recovery, methods and technique of light oil examination remained the same throughout the investigation. The only two variables were the oils tested and the cracking temperature. The control of the latter was based on four thermocouples and the averages for a run was within ±3°F. of the temperature indicated. The rate of oil input was kept constant at 12.5 cc. per cu. ft. of blue gas which is equivalent to 3.3 gallons per M of blue gas or 2.75 gallons per M of finished gas.

The properties of the oils used in the tests and the results obtained are presented in the tables which follow:

TABLE 1

Oil	*Sp.Gr.*	*Be*	*Viscosity at 60°F.*	*Fractionation* 0-300	300-400	400-500	500-600	600-700	700-750	*Residue*	*Description*
Mid-Continent No. 1	.8419	36.3	11.04	—	—	70%	23-4	2.3	3.3	0.3	Light yellow
Mid-Continent No. 2	.8934	26.7	1.2	—	—	4.4	17.1	22.6	49.5	3.7	Thin dark oil
California	.9365	19.5	53.4	.4	.3	2.9	16.6	41.5	25.0	10.1	Black viscous topped crude

*Assistant Chemist, U. S. Bureau of Mines.

TABLE 2

I	II	III	IV				V	VI	VII	VIII	IX	X
Temp. of furnace degrees F.	Light oil in per cent of gas oil	Specific gravity light oil below 200° C.	Fractionation in percentage of light oil (by volume) 75-100° A	100-120 B	120-140 C	140-160 D	160-200 E	Total unsaturation (to Bromine) in per cent of light oil	Unsaturation in fraction D (mainly styrene) in per cent of total light oil	Unsaturation in fraction E (mainly indene) in per cent of total light oil	Total unsaturation X 100 in per cent of gas oil	Indene fraction (160-200° C.) in per cent of gas oil X 100	Unsaturation of indene fraction E (160-200° C.) in per cent of gas oil X 100
Mid-Continent Oil No. 1													
1300	6.3	.887	35.4	26.4	13.5	12.4	12.1	18.5+	5.31	8.41	117.1	76.6	52.9
1350	6.7	.878	47.2	27.4	6.5	10.6	8.4	13.5	4.26	4.86	90.5	56.3	32.2
1400	6.1	.885	62.4	19.7	5.6	6.4	5.8	10.0	3.12	3.93	61.0	35.4	23.8
1450	4.86	.885	62.4	19.0	6.3	7.1	5.2	11.1	4.10	4.0	53.9	25.3	19.4
Mid-Continent Oil No. 2													
1350	6.1	.883	44.7	24.5	9.6	11.7	9.6	16.07	5.19	6.83	98.7	58.9	41.9
1400	4.5	.886	46.15	27.9	7.7	9.6	8.65	13.93	4.82	6.41	62.7	39.0	28.9
California Oil													
1350	5.6	.888	45.75	26.6	9.55	10.55	7.55	16.1	6.08	6.50	90.3	42.4	36.5
1400	4.67	.888	43.5	28.8	9.4	10.59	7.65	16.1	5.64	6.59	75.2	35.7	30.8

Discussion:—In Table I will be found the characteristics of the gas oils under self-explanatory headings. The results of the investigations are given in summary in Table II. The column headings in this case are full and self-explanatory. By a comparison of the data, which are given in lines 2, 3, 5, 6, 7, and 8, it will be seen from Column II that for different gas oils, the resultant light oils vary in amount, in composition (Column IV), in total unsaturation (Column V), in the degree of unsaturation of the principal gum-forming fractions (Columns VI and VII), and finally in the relative magnitudes of the indene fractions (Column IX) and in the indene contents of those fractions based on a unit volume of gas oil cracked (X).

The table need not be analyzed further at this time, for from the present point of view the amount of gum-forming constituents per unit volume of gas oil, the Mid-Continent oil No. 2 may be said to have given the greatest amount, the California oil next and the Mid-Continent oil No. 1 lowest of gum-forming material when cracked under the conditions indicated.

Operation:—However, the data of the Table II furnish information of much greater value than that just given. Your attention is directed to the variation in values throughout the table with the changes in temperature. This is shown very clearly in the case of the first gas oil where the cracking was carried out at four temperatures whose extremes approximate practical working limits. As is to be expected, the light oil diminishes (and the oil gas volume increases) with rise of cracking temperature above 1350° F. (Col. I and II.).

Under Column IV, it is to be noted that, in the case of the two Mid-Continent oils, there is a shift to the left in the percentages with increase of temperature. This means within the usual cracking range that, with increase of temperature, the light oil contains more benzene and toluene and less of the higher boiling hydrocarbons which condense and constitute the greater part of the drip oil and meter condensate. That the same general variation occurs in the unsaturated hydrocarbons is evident from Columns V, VI, and VII. The most significant figures, however, are those of the three last columns. In going from a cracking temperature of 1350° to 1400° F., the total unsaturation figures for the light oil from unit volumes of the Mid-Continent oil change from 90.5 to 61.0 and from 98.7 to 62.7. For the California oil, the change is from 90.3 to 75.2. In a like manner, the relative volumes of the indene fraction (b. 160-200° C.) changes from 56.3 to 35.4, 58.9 to 39.0, and 42.4 to 35.7, respectively. Finally, the actual indene measure changes under the same conditions in the following ratios, 32.2 to 23.8, 41.9 to 28.9, and 36.5 to 30.8. With these facts and figures before you, it is desirable to quote from the paper of the writer in the May A. G. A. *Monthly* relative to the plants studied during the survey of 1922. "In eleven generating plants, supplying carburetted water gas to systems in which no gum trouble was occurring, the average of the pyrometer readings or reported values for carbureter (bottom) temperatures was 1374° F. For seven systems in which there was distinct trouble, this average value was 1329° F. In the first set of eleven cases, one plant was employing a temperature below 1350° F. (The rate of oil input was relatively low.) In the second set of seven, one plant showed a value above 1350° F. It can now be no longer doubted that the character of the gas oil bears a direct relationship to the amount of gum-forming constituents in the resultant gas. It is further evident the cracking temperature is a very important factor in the quantity of gum-forming constituents in carburetted water gas.

In the carburetting operation, the major factors are greatly interdependent as discussed in previous reports. The most tangible points of control over the composition of the light oil in the gas are temperature and contact. The latter includes the time element which can be made to vary with the rate of oil input as well as with the quantity factor variable with the number and spacing of the checker brick. It has long been established that in cracking, contact time and surface may be varied reciprocally with temperature. This means that high rates of oil input and wide checker-brick spacing are equivalent to a reduction of the cracking temperature which must result, as has just been shown, in a serious increase in gum-forming constituents in the gas. In last year's report, attention was directed to the paralleling of high rates of oil input with a gummy condition of the meters. It is evident that the operation of the carburetting units is of extreme importance in the production or non-production of gum-forming constituents in carburetted water gas.

The importance of careful and correct operation of those units can hardly be over-emphasized when it is considered that, while it constitutes only about 20 per cent by volume, the oil gas contributes well over half of the heating value of carburetted water gas. Development in these units and their

operation might well be receiving a larger and more proportionate share of the research energy and attention of the industry.

II. Carburction: Light Oil Composition

It was the original plan to present information on the amount and character of the light oil in carburetted water gas being distributed under the present thermal standards, and taken from systems which experienced varying amounts of difficulty due to the deposition of gum. The results for one plant can be presented at this time.

This plant distributes nearly two million cubic feet per day. The oil used is a 32-36° Be gas oil from an Oklahoma field, and the input is 3.12 gallons per M. The light oil content of the gas was found to be .3065 gallons per M cu. ft. The tar per M cu. ft. amounts to 0.353 gallons and the drip oil to 0.031 gallons, practically all of which is collected within a half mile of the plant. The characteristics of the light oil from this plant were as follows:

TABLE 3

Boiling Ranges, Degrees Centigrade

	0-100	100-120	120-140	140-160	160-200	Total	
Total hydrocarbons in per cent boiling below 200° C.	IV-A 66.8	IV-B 20.8	IV-C 5.5	IV-D 4.7	IV-E 2.3	100%	IX 22 6
Unsaturated hydrocarbons in per cent of total L. O. boiling below 200° C.	6.5	2.7	2.0	VI 2.05	VII 0.75	detnd. 17.8 by add. 14.0%	X 7.4

This plant* was selected for study because, in the twelve years of its existence, the meter removal for cause has never exceeded 1¾ per cent per year and no gum trouble in meters or pipes has been experienced. The reason largely lies in correct and efficient operation. The calculated cracking efficiency (on a 70 cu. ft. and 300 B.t.u. basis) runs at 105 or better. Attention is directed (Table 3) to the extraordinarily high percentage of the light oil present in the benzene and toluene fractions. Conversely, there is little high boiling material in the gas. As a consequence, there exists a very proper and desirable ratio between the light oil in the gas and the drip oil. For purposes of correlation and comparison, Roman numerals have been placed in the squares of Table 3 to indicate the corresponding figures in Table 2 given earlier. It will be seen that, from the standpoint of the non-production of gum-forming constituents, better cracking results are being obtained in this plant than under the optimum experimental conditions reported in Table 2.

We have dealt, up to this point, with the production of the primary gum-forming constituents of carburetted water gas and their control and have seen that the properties of the oil have a certain influence on the amount of these constituents formed. But we have also seen that operation is a greater factor. This is true because equal or greater variation occurs in amounts of gum-forming constituents through operative measures than through differences in the three oils tested. Operation is a more elastic control measure and less subject to change by reason of changes in economic conditions in the oil industry.

III. Purification: Excess Oxygen

We shall now go to the other general factor in gum formation—the oxygen content. Oxygen is a thoroughly general factor because it is functioning wherever there is a collection of drip oil in rusty pipe, in meters, in regulators, etc. Its presence in the gas is cer-

*No. 14 in last year's survey (1922).

AIR REVIVIFICATION TESTS REPORTED BY PLANT NO. 1

	Inlet Pur. House				*Inlet Box 2*		*Outlet Purifiers*	
Water Gas	H_2S	O_2	Temp.		H_2S	O_2	H_2S	O_2
April 3rd	100	.5%	85°	Set 1	2.	.7%	3.	1.1%
				" 2	2.	.8		
				" 3	2.	1.0		
April 4th	113	.6	85°	Set 1	19.	.9	2.	.8
				" 2	2.	.9		
				" 3	40.	.5		

There are 3 sets of 4 boxes each. One is taken off daily from each set of 4. Revivification in situ in the others.
Not feasible to change the percentage admission of air.
Sulphur in generator coke 8/10%
Sulphur in gas oil 5/10%
Oil per M 3.55 gallons.
Oxygen results not consistent.
1.5% air admitted.

AIR REVIVIFICATION TESTS REPORTED BY PLANT NO. 2 ON COAL AND WATER GASES

	Inlet Box 1			*Inlet Box 2*			*Oxygen Loss*	*Inlet Box 3*			*Inlet Box 4*			*Outlet Last Box*			*Air*
COAL GAS	H_2S	O_2	Temp.	H_2S	O_2	Temp.	%	H_2S	O_2	Temp.	H_2S	O_2	Temp.	H_2S	O_2	Temp.	Admitted
Apr. 23, 1923 81 M	280	1.9	82°	80	1.7	92°	.2	—	—	86°	—	—	76°	—	1.8	64°	4%
Apr. 26, 1923 79 M	300	1.3	76°	180	1.2	86°	.1	—	—	86°	—	—	80°	—	1.3	68°	4%
Apr. 27, 1923 138 M	520	1.6	65°	250	1.5	83°	.1	10	—	86°	0	1.5	80°	0	1.5	75°	5%
Apr. 27, 1923 100 M	530	.6	60°	350	.5	80°	.1	20	—	82°	0	—	77°	0	.5	75°	None
WATER GAS																	
Apr. 23, 1923 116 M	260	1.1	98°	180	1.1	94°	0			94°			94°		1.1	92°	4%
Apr. 26, 1923 103 M	270	.6	116°	30	.5	113°	.1			100°			83°		.7		4%

Sulphur in coal 2% Sulphur in oil .6%

O_2 ABSORBED BY PURIFYING RICH COKE OVEN GAS COMPANY NO. 3

Date	*Inlet 1* H_2S	O_2	T	*Outlet 1* H_2S	O_2	T	*Oxygen Loss*	*Outlet 2* H_2S	O_2	T	*Outlet 3* H_2S	O_2	T	*Outlet 4* H_2S	O_2	T	*Sulphur in Coal*
3/10/23	400	.6	60	300	.3	75	.3	Not tested			Not tested			15	.3	77	1.16%
3/12/23	360	.6	64	260	.4	77	.2	do.			do.			10	.4	81	1.32
3/13/23	330	.7	65	240	.4	80	.3	do.			30	.3	80	Not tested			1.35
3/14/23	330	.7	64	270	.5	77	.2	174	.4	79	86	.3	81	15	.3	82	1.22
3/15/23	360	.7	64	270	.5	80	.2	190	.4	80	60	.4	81	Not tested			1.19
Date	*Inlet* 2	O_2	T	*Outlet* 2	O_2	T	O *Loss*	*Outlet* 3	O_2	T	*Outlet* 4	O_2	T	*Outlet* 1	O_2	T	
3/16/23	360	.6	66	270	.4	79	.2	180	.3	81	70	.3	81	Off			1.19
3/17/23	380	.7	60	240	.5	79		160	.4	79	115	.4	80	10	.4	80	1.13
Date	*Inlet* 3	O_2	T	*Outlet* 3	O_2	T	O *Loss*	*Outlet* 4	O_2	T	*Outlet* 1	O_2	T	*Outlet* 2	O_2	T	
3/27/23	310	.8	65	200	.5		.3	110	.4		40	.4	78	Off			1.22
3/28/23	400	.6	58	290	.5	69	.1	180	.4	74	90	.4	74	30	.3	76	1.26
3/29/23	360	.6	59	260	.4	69	.2	150	.3	71	90	.3	73	20	.3	74	1.39
3/30/23	390	.6	63	300	.5	76	.1	210	.4	76	140	.4	77	30	.3	76	1.12
3/31/23	300	.7	61	230	.5	73	.2	160	.5	75	90	.4	75	30	.4	76	1.23
4/2/23	310	.6	63	240	.4	75	.2	180	.4	76	100	.3	76	40	.3	77	1.18
Date	*Inlet* 4	O_2	T	*Outlet* 4	O_2	T	O *Loss*	*Outlet* 1	O_2	T	*Outlet* 2	O_2	T	*Outlet* 3	O_2	T	
4/10/23	240	.8	61	190	.6	72	.2	160	.4	74	90	.4	74	Off			.88

Air introduced 1.8%; oxygen .4%. No steam used in boxes.
1st set of 4 boxes for crude gas; each 3 currents through 30″ oxide.
Rate flow, 2000 cu. ft. in 24 hours per sq. ft. of each layer.
Residual H_2S, 40 to 10 grains; average H_2S at inlet for 1.2% sulphur coal, 356 grains.

O_2 ABSORBED BY PURIFYING RICH COKE OVEN GAS, GAS COMPANY NO. 3

Date	*Inlet Box 1* H_2S	O_2	T	*Outlet 1* H_2S	O_2	T	*Oxygen Loss in %*	*Outlet 2* H_2S	O_2	T	*Oxygen Loss in %*	*Outlet 3* H_2S	O_2	T	*Oxygen Loss in %*	*Outlet 4* H_2S	O_2	T	*Oxygen Loss in %*	*Remarks*
May 25 A	350	1.0	71	250	.4	76	0.6	H												Sulphur in coal 1.03. Make per hour about 480 M
B	300	.4	73	250	.2	79	0.2	150	.2	79	—	100	.2	79	0	50	.2	79	0	
May 28 A	240	.8	69	176	.4	72	0.4													Air introduced: A tests 1.7% B tests 1.0%
B	220	.5	71	160	.2	75	0.3	90	.2	78	—	60	.1	78	1	25	.1	76	0	
May 31 A	210	.7	68	150	.4	73	0.3													
B	290	.4	69	190	.2	72	0.2	140	.2	73	—	80	.2	74	0	30	.2	73	0	
June 1 A	290	.6	71	200	.4	73	0.2													
B	260	.4	73	190	.3	77	0.1	110	.2	77	1	80	.2	77	0	40	.2	76	0	
June 4 A	240	.8	73	180	.6	78	0.2													
B	250	.4	79	190	.3	82	0.1	110	.2	83	1	80	.2	83	0	20	.1	84	1	
June 8 A	240	.6	70	140	.4	74	0.2													
B	250	.4	70	190	.3	74	0.1	100	.3	76	—	80	.4	77		30	.3	77	1	Make per hr. 460 M
June 6 B	260	.7	79	180	.4	84	0.3	110	.4	86	—	70	.6	89		20	.5	89	1	Air introduced: A test 1.7% B test none Air meter shut off

There is a 2 to 3 per cent leakage of air into the vacuum.
Oxygen is not measurably absorbed after the first box, and more than is consistent is absorbed in the first box.

AIR REVIVIFICATION TESTS REPORTED BY PLANT NO. 4

	Inlet Box C H_2S	O_2	T	*Outlet Box C* H_2S	O_2	T	*Oxygen Loss*	*Outlet Box D* H_2S	O_2	T	*Outlet Box A* H_2S	O_2	T	*Outlet Box B* H_2S	O_2	T	*Oxides*
COAL GAS																	
1st Test	95	1.0	74°	45	1.0	—	0.0	25	.9	—	20	.9	—	0	.8	—	In C, Sun & Canadian 2nd time, Sulphur 44.1%
	Box B			*B*				*C*			*D*			*A*			
2nd test after Rotation	135	1.2	—	15	1.1	—	0.1	5	.9	—	0	1.1	—	0	1.0	—	In D, Elk & Canadian 4th time Sulphur 45.4 In A, Colegaz & Long 3rd time Sulphur 37.2 In B, Elk & Canadian 1st time Sulphur
	B			*B*				*C*			*D*			*A*			
WATER GAS																	
1st test	85	.5	91°	30	.5	—	0.0	5	.5	—	0	.5	—	0	.5	92°	Air admitted 1.% Temp. at air inlet 105
	C			*C*				*D*			*A*			*B*			
2nd test	90	1.0	90°	25	.7	—	0.3	5	.4	—	0	.4	—			94°	Air admitted 1.05% Temp. at air inlet 102
	D			*D*				*A*			*B*						
3rd test	95	.5	90°	50	.4	—	0.1	10	.5	—	0	.5	—			95°	Air admitted 1.0% Temp. at air inlet 108

AIR REVIVIFICATION TESTS REPORTED BY PLANT NO. 5

	Inlet 1st Box H_2S	O_2	T	*Outlet 1st Box* H_2S	O_2	T	*Outlet 2nd Box* H_2S	O_2	T	*Outlet 3rd Box* H_2S	O_2	T	*Outlet 4th Box* H_2S	O_2	T	*Hourly Make*
Coal gas:	510	.9	105	283	.9	—	199	.9	—	108	.8	—	0	.9	110	Est. 80,000 cu. ft.
	Air admitted 2.5%						Sulphur in coal 1.04%									
	The boxes hold 6,360 cu. ft. oxide each, all filled with borings oxide for the first time in use.															
	Time oxides had been in service: 1st box 120 days; 2nd box 60 days; 3rd box 210 days; 4th box 205 days.															
Water gas:	230	1.1	140°	85	1.5	—	18	1.5	—	0	1.4	—	0	1.3	120°	
	Air admitted 1.5%						Sulphur in generator fuel .7%									
	Days oxides in service: Box 1—270; Box 2—250; Box 3—180; Box 4—3.															

tain where revivification *in situ* is employed as it is at the present time. In last year's report, it was pointed out that the oxygen content averaged 0.8 per cent or more and that since the calculated theoretical requirements for a gas containing 100 grains of H_2S was less than 0.1 per cent of oxygen, the oxygen being added was theoretically some 8 to 10 times that required. It was thought desirable to determine the practical working consumption of oxygen in purifier boxes. To this end a sub-committee, with Dr. J. F. Wing as chairman, was instituted with its membership drawn from the Purification and Deposits Committees. Dr. Wing's report, in full, follows:

Report of Sub-Committee on the Air Needed for Revivification in situ in Purification

Tests have been reported from five sources. These tests are not at all conclusive, but will, at least, supply data for study.

They all indicate that, under all the conditions existing at the time of the tests, considerably less admitted air would have served the purpose desired and less surplus oxygen would have passed on.

In examining the results of Plant 1, I note great inconsistency in the oxygen figures, notably in the amounts at the beginning and end of the passage of gas. The large amount of H_2S removed in the first box, 60 per cent, 80 per cent and 98 per cent, indicates great activity, and the possibility that the analysis may be nearer right than the air meter. The residual H_2S is quantitatively insignificant.

The results of No. 2 show the oxygen absorption to be measurably consistent and indicate the possibility that less air, than is usually introduced, is needed. There is effective absorption of H_2S, although the areas of the purifiers are not given.

In the results of No. 3, the oxygen absorption is measurably consistent, but it more than corresponds to the H_2S absorption, and practically all occurs in the first box, where there is the most H_2S.

Under the existing conditions, the 2 per cent air leakage into the vacuum supplies sufficient air for revivification.

The tests reported by Company No. 4 show very little oxygen absorption and indicate that an unnecessary quantity of air was admitted into the boxes.

The tests, reported by Gas Company No. 5, show that, in the case of the coal gas which passes through four boxes, all filled for the first time with new oxide, the oxygen content of the gas is not reduced at all, but that the sulphur is entirely removed by the oxide and that the addition of air seemed unnecessary. In the water gas purification, the oxygen reduction is consistent in the passage through the boxes, but the quantity of air present is unnecessarily large.

J. F. Wing, *Chairman.*

There seems to be little more to be said in summary except that, in the case of water gas, the actual oxygen consumption is approximately 0.1 per cent and in the case of coal gas, with its greater H_2S content, the oxygen consumption is approximately proportionately higher.

On the basis of theoretical demands and of the practical operating data at hand, the average present-day oxygen input is unnecessarily large and excessive.

Acknowledgments

The Chairman desires to extend his appreciation, in addition to the acknowledgments already made, to Mr. R. B. Harper of Chicago, to Mr. E. H. Lewis, General Manager of the St. Louis Gas Company, and to Dr. J. F. Wing and his collaborators,—Messrs. E. C. Uhlig, A. F. Kunberger, R. L. Fletcher, and C. E. Littell.

Summarizing Statement of Work on Gummy Meter Problem

The report of this committee for 1922 brought out the facts together with evidence:

1922

1. That gummy meter troubles were due to the unsaturated hydrocarbons which condense and collect in the pipes and meters; the principal members were identified and their properties described;

2. It was shown that oxygen was a general factor in gum formation and subject only to the presence of unsaturated hydrocarbons; other specific and minor factors were mentioned in some detail;

3. A survey of a considerable number of plants was made and it was pointed out that the presence of gummy deposits paralleled very closely the high rates of oil input;

4. A logical and scientifically correct explanation of this observation was offered. This had to do with incomplete and non-uniform cracking of oil.

The report of the committee of this year, 1923, which has just been read has shown:

1923

1. That gas oils of different properties cracked under the same conditions will give different amounts of gum forming constituents in the resultant oil gas;

2. Of greater importance, was the fact shown by this work that the variation in cracking temperatures exerted a very marked influence on the amount of unsaturated material in the gas and specifically on the amount of gum forming constituents. Confirmatory evidence on the practical side from the survey of last year was likewise presented. It has been shown to follow from these facts that incomplete cracking or non-uniform cracking as evidenced by the presence of gum forming constituents must result from excessive rates of oil input (cracking period) or insufficient contact unless compensated in some other way;

3. The light oil composition has been presented for one plant whose meter condition has been ideal;

4. It has been shown that the average oxygen input in the purifier box is generally excessive.

There remains to close up this work on gummy meter problems:

1. The completion of the survey of the light oil composition in various carburetted water gases;

2. The completion of work on methods of analysis;

3. The vapor pressure of indene is highly desirable;

4. Methods for selective removal of indene and other gum forming constituents at the plant should be considered. Initial indications of work begun are very promising.

DISCUSSION

C. J. Ramsburg (Pittsburgh, Pa.): This is an extraordinarily valuable paper, and attempts should be made to bring the information in a practical way to the man who is making water gas and having trouble with his meters.

It seems to me first, that in the general lowering of the B.t.u.'s that has taken

place throughout the country in the last five years there has been a marked increase in the amount of trouble with meters, particularly in plants making water gas. One would suppose from this paper that where the oil per thousand had been reduced, the content in light oil of indene and styrene and these unsaturated compounds would have been lowered, because the oil had been better treated in a water-gas machine.

I think one explanation would be that the average water gas plant, when they lower their B.t.u.'s and lower their oil per thousand, immediately runs into naphthalene formation. To avoid the naphthalene the heats in the water-gas cracking plants were all reduced, and in reducing those temperatures this paper indicates the reason why they have more trouble with the meters.

Now, if in lowering these temperatures we are going to transfer the troubles to the meters, it seems to me that the practical thing to do would be to maintain the heats, and still prevent the naphthalene giving trouble through the distribution system, by treating the gas with cold water or by oil washing in some way to prevent the naphthalene getting in.

My talk is largely to ask the question whether this is not a possible explanation of why so much trouble has come about in the meters in the last few years —if this point about the naphthalene is not well taken?

E. C. Uhlig (Brooklyn, N. Y.): We have had considerable gum troubles, but of late years they have practically ceased. We made some tests on the indene content of the gas by a method suggested by Dr. Brown, and we found that the gas leaving the works contains indene but the gas on the district a mile from the works does not. The drip pump in the street did contain indene, showing that whatever indene is sent out in the gas from the works is taken care of by the street mains.

There have been some changes in our method of operation. When we were under the candle-power standard we had considerable trouble with gum in meters. We went on the B.t.u. standard with the result of an increase in temperature and a decrease of six-tenths of a gallon in the oil per thousand. This means an increase in heat content, and that may explain the lessening and final cessation of the gum troubles.

A reference is made to the influence of oxygen in secondary gum formation. Our oxygen in all this period has run practically the same and the gum has ceased. Therefore, in our case there appears to be no secondary action of oxygen on the gum formation.

While the gum formation is one meter trouble, we have another which is just as serious as the gum was in the past. That is rusting and corrosion. It is probably due to the high water content of the gas, and I think that the work of the Condensing and Scrubbing Committee will have a great bearing in solving that problem, by designing efficient methods of condensing gas.

C. A. Schnerr (Chicago, Ill.): We have been remarkably free in our history from gum although we have seen evidences of it at various times. I am inclined to agree with Mr. Ramsburg as to effect of a lower temperature and higher oil input. Formerly we had large amounts of condensate which, without doubt, contained a great deal of indene. We had gum formations from the drips. At the present time we are scrubbing our gases and getting gum

in the scrubbing, but we do have deposits in the street. Those deposits are almost primarily oxidations of the mains, services, etc., and are mixed with small amounts of naphthalene and hydrocarbon. But it seems that if we go on with a slightly higher temperature the probability is that we will stay away from the resinous matter.

N. G. Caputi (Salem, Mass.): I have read Mr. Brown's paper with considerable interest and also last year's paper in connection with our situation in Salem. We have been troubled in a large degree with this gummy deposit in the past. At present we are still having some trouble which we are following up. About two years ago this substance made its first appearance and after certain tests and observations of characteristics the presence of the cumerone deposits which were mentioned in last year's paper was established.

We have given this cumerone deposit plenty of thought, and have taken samples of the drips and found the gummy deposits there. After our biggest trouble, we installed additional condensing capacity. That relieved our troubles considerably, but, as I said before, complaints are still recorded.

Our largest user of gas manufactures incandescent electric light bulbs, and they have reported gummy deposits at the burners, and at the needle valves which control the mixture of air and gas. Before I left, I took the needle valve along with me, and you can see it has a deposit of gummy material which was pretty well baked on much like a shellac or varnish. I would like to pass it around to some of my associates here and see whether there is some method for preventing this deposit.

Tests indicated that none of this gummy deposit was present at the inlet of the factory so that it must be picked up in the lines beyond the meter. Immediately following the meter they have a booster for increasing the pressure to seven inches. We find, too, that where the air first comes in contact with the gas, the deposit is greater, and we think that, the temperature of the air being lower than the gas, it is condensing some of these hydrocarbons at the point of mixture and leaving this gummy deposit.

We do not get any of this gummy deposit at the outlet of our plant but at this particular concern the deposit is quite troublesome. We are flushing out those mains now with benzol in the hopes of finally clearing up this trouble, but we cannot understand the deposit beyond this consumer's meter when there is none at the plant, and no large amount in the drips.

I understand that there are some of these same lamp concerns in Harrison, New Jersey, who are having this same trouble. Possibly the gas men in or about Harrison can tell us of some of their experiences and suggest a remedy.

Mr. Ramsburg's suggestion appealed to me greatly as we have found at the plant that running the high heats to overcome this gummy trouble produces the naphthalene which we had some difficulty in removing. If some practical suggestion could be made for avoiding the naphthalene, it would help us considerably.

J. W. Tierney: The report states that a particular plant was investigated, and that the reason they have no trouble lies in correct and efficient operation. Now I am quite familiar with the plant referred to. It has been in existence only twelve years. It is distributing 100 per cent water gas, and the main drip

is located half a mile from the plant. When you take a plant that is a combination plant, coal gas and water gas, you have a different condition, and I do not think that the wording "efficient operation" for one particular plant should apply to efficient operation for another.

The same plant distributes this gas under a high pressure and probably that has something to do with its having no gum trouble. I raise those points to see whether this particular plant, carrying a maximum pressure of 30 to 35 pounds at peak time, has the same problems to solve as a coal gas plant has with coals of varying grades to contend with. Its oil is probably uniform the year round.

F. J. Ikena (Baltimore, Md.): Have they lowered the B.t.u.'s in that particular plant in twelve years?

J. W. Tierney: They are located in Missouri. They have a standard of 570 B.t.u.'s and they have not lowered that within the last ten years anyway.

F. J. Ikena (Baltimore, Md.): Have they increased the capacity of their sets since that time? That would have some relation with the oil feed.

J. W. Tierney: They are increasing it right now, but the machine is not installed. They are loaded right up to the peak of manufacturing capacity.

J. L. Eigenbrot (Lowell, Mass.): Our send-out consisted of about 70 per cent water gas and 30 per cent coal gas up until November of last year, when the percentage of coal gas was increased. For the last six months the coal gas has amounted to 92 per cent of the sendout. Upon the increase in coal gas this gummy deposit has manifested itself.

The talk this afternoon has been essentially on water gas. The experience at Lowell with coal gas seems to introduce another phase.

J. M. Weiss (New York, N. Y.): One chemical point has possibly been overlooked by the committee. In trying to use unwashed coal tar fractions in automobiles, you get a gummy deposit which blocks up your feed line, but which has nothing to do with cumerone or indene; it is almost exclusively a polymerization product. The pentadiene is characteristic of coal as opposed to water gas. Now there is one way of distinguishing it. That is that the pentadiene material is not soluble in benzol, whereas the cumerone and indene polymerization products are. Have any of the people who have had gummy deposits in meters tried to clean them with benzol and failed?

H. M. Balsam (Haverstraw, N. Y.): Owing to some derangement of the big holder we were obliged at one time to operate a small plant on the relief holder and the plant had to be in operation continuously for the 24 hours. To my knowledge they never had any gummy deposit troubles, but on one occasion the fan broke down and the gas man, in an effort to keep up the supply, was obliged to make a run without a blow. Naturally the temperature in the carburetor was down and they made three or four of these runs before the fan was back in place. Almost immediately there was evidence of gummy deposits all over the town, especially near the plant. That, I believe, proves conclusively that the lowering of the temperature in the carburetting of the oil will produce gummy deposits.

R. L. Brown (Pittsburgh, Pa.): I am very heartily in accord with the remarks of Mr. Ramsburg. I would add that when the amount of oil input was

high, as with the higher B.t.u. standard, the amount of condensate in the mains was much larger; the percentage of benzene was considerably higher.

With reference to the remarks of Mr. Uhlig, I would cite our experience last year. We investigated the variation in the composition characteristics of drip oils from plants having trouble compared with those which did not have gum trouble. We found that the drip oils were very much alike, but in those systems in which difficulties were being experienced with gummy meters, the condensate in the outlying drips and in the meters when it occurred was aqueous, not oily, except in mere traces. The reverse was true in the case of those plants which were not having meter trouble.

The evidence is overwhelming that oxygen does enter in the gum formation. Alone it cannot produce gum, just the same as you cannot make mortar with water alone. If you have the gum-forming constituents in the unsaturated hydrocarbons, the oxygen, if present, will enter, and in that sense it is a secondary factor and it does operate. You find gums taken from meters where they have stood a long time will have an oxygen content as high as 20 per cent, 17 per cent, 21 per cent, 22 per cent, and sometimes a little higher.

With reference to the remarks of Mr. Tierney. At the plant referred to they are distributing under both normal pressure and increased pressure, and the situation as we found it was the same in either case. It was not intended to infer that other plants were necessarily inefficient.

The conditions cited at Lowell are new to our experience, and I am necessarily limited in what I can say there.

Pentadiene has not been overlooked by any manner of means. On the other hand, meter condensates taken from any number of meters have been definitely proven, with respect to their unsaturated hydrocarbon content, to be made up of 95 per cent of the unsaturates, indene and styrene, and some others which boil in the range of the benzine fraction. I do not say that pentadiene, etc., does not enter into gum formation, but the great majority of troubles come from the two that I have mentioned.

The straight polymerization products of unsaturated hydrocarbons are soluble in benzine. In general, as the oxygen content increases due to auto-oxidation and a complicated set of reactions, the solubility decreases in benzine, and correspondingly their solubility in such materials as acetone, which contains oxygen as part of its molecular constitution, goes up.

REPORT OF THE PURIFICATION COMMITTEE

Dr. A. R. Powell, *Chairman*, Pittsburgh, Pa.

Outline of Work

The work of the Committee for this year has been directed along somewhat other lines than the committees of the last few years. In accordance with the request of the Managing Committee, more attention has been paid to the objectionable constituents of gas other than hydrogen sulphide. The majority of work in the past has emphasized iron oxide purification rather strongly, but this year the major part of the committee's activity has been directed towards organic sulphur and cyanogen in gas. Liquid purification, which is one of the outstanding developments of modern gasworks practice, has also received attention, and a paper is to be presented this year which will bring this subject up to date.

The work of the committee may be divided into four major parts.

1. *Organic sulphur in gas.* Data on the amount of organic or fixed sulphur in gas from different plants were collected by J. B. Craven of Chicago and are submitted as a part of this report. (Appendix A.) Various members of the committee cooperated in this work, as well as several others not on the committee.

A. R. Powell prepared a resumé of processes which have been used for the removal of organic sulphur from gas with particular reference to American gas practice. (Appendix B.)

2. *Liquid Purification.* The committee as a whole did no work on this subject, but a paper is to be presented by F. W. Sperr, Jr., which will bring together information gleaned from several plants where this process has been installed.

3. *Cyanogen in Gas.* W. A. Dunkley investigated this problem with special attention to the corrosive properties of cyanogen in gas. It was found that little or no data were available on the subject, but the committee finds that at least two investigations on this general problem are being carried on by gas companies, and that the data so collected will be available at a later date.

4. *Correlation of Laboratory tests and plant results* as regards activity and capacity of oxides. The laboratories of the Consolidated Gas Company of New York have been carrying on investigations of iron oxide for several years, and it was hoped that a report on this by C. A. Lunn and W. L. Kohlmann could be published in this year's Proceedings.

Unfortunately, however, this report has been somewhat delayed, but it will probably be presented to the Association at an early date. This investigation clears up many doubtful points raised in connection with the commercial evaluation of iron oxide, and should prove of considerable interest to laboratories which test oxides for gas purification purposes.

Appendix A

ORGANIC SULPHUR IN GAS FROM TYPICAL PLANTS

Data collected by J. B. Craven

The organic or fixed sulphur content of gas is very seldom determined, despite the fact that state and municipal regulations often limit the quantity of total sulphur in the finished gas. This has been due very largely to the assumption, which has been confirmed in most cases, that the organic sulphur will always remain under 30 grains per 100 cubic feet, and that the purification process will eliminate all but a trace of hydrogen sulphide, thereby assuming that less than 30 grains of total sulphur, the usual legal limit, will be present in the gas.

The Committee on Purification for last year collected some data on fixed sulphur in gas by the questionnaire method. This resulted in some data on the amount of total sulphur in the purified gas. The variation in the fixed sulphur content at different points was not determined, however, in most cases, and furthermore no attempt was made to differentiate between the true fixed sulphur and traces of hydrogen sulphide. The results of this survey, with possible practical applications, have been described by J. B. Craven and W. A. Dunkley†.

In order to gain further knowledge of the fixed sulphur content of gas at different points of the purification system and in different types of installation, this year's committee undertook further investigation of the subject. Different members of the committee performed tests in their own plants, and in some cases secured the cooperation of other plants.

The data so secured represented water gas plants, vertical retort plants, inclined retort plants, and coke oven plants. Where iron oxide purification was used the organic sulphur content of the gas was determined at both the inlet and the outlet of the boxes. In some cases the fixed sulphur was also determined at the inlet of the exhauster and the inlet of the

†A. G. A. Monthly, vol. 5, pp. 251-4 (1923).

P. and A. extractor. In one plant the Seaboard liquid purification process was used, and analyses were made for organic sulphur at the inlet and outlet of the absorber. In another case determinations were made at the inlet and outlet of the light oil scrubbers. The results of this survey cleared up several points concerning the fixed sulphur content of gas.

The method of analysis which was used was designed to give an accurate measure of the organic sulphur, as differentiated from any hydrogen sulphide which might be in the gas. The sample of gas for the determination was first passed through a train of bottles containing a neutral solution of cadmium chloride. By this means the hydrogen sulphide was removed without causing any appreciable amount of organic sulphur to be removed. The gas was then metered and burned in a Referees apparatus in the usual manner.

The results of this survey are summarized in the attached table.

Date	Organic Sulphur in Gas Grains Per 100 Cu. Ft. In Exhauster	In Pand A	In Boxes	Out Boxes	% Sulphur in Coke	Oil	H_2S at Inlet of Boxes Grains Per 100 Cu. Ft.	Steam Introduced With Gas in Boxes	Temp. at Inlet of Boxes °F	Cu. Ft. Oxide Per Million Cu. Ft. Gas Per Day
Plant "A"										Water Gas
March 19–23	—	17.9	—	11.9	1.14	Avg. for	210	No	85	10,350
" 26	9.5	9.0	9.1	7.8	1.05	(1920)	140	"	80	10,761
" 29	—	10.3	12.4	—	1.05	0.19	140	"	95	7,371
April 13	—	—	5.8	4.0	1.05	(1921)	120	"	80	11,370
" 15	—	—	10.6	9.4	1.09	0.29	160	"	80	9,828
June 20	—	—	Lost	8.9	1.99		140	"	90	6,568
Plant "A"										Verticals
	In Seaboard	Out Seaboard			Coal					
March 1–23	—	—	13.5	16.8	1.69	—	290	No	59	5,144
" 6	22.1	22.6	—	—	1.57	—	70	"	74	5,144
April 10	—	—	8.2	8.8	1.07	—	50	"	62	5,144
" 13	8.7	11.1	—	—	1.07	—	40	"	61	5,144
May 15	—	—	15.3	14.6	1.22	—	30	"	64	5,144
" 17	16.2	14.9	—	—	1.22	—	40	"	62	5,144
June 21	13.6	12.8	11.5	13.9	0.87	—	60	"	87	5,144
Plant "B"										Inclines
April 9	—	—	22.5	10.1	—	—	—	No	—	—
" 17	—	—	21.5	19.3	—	—	—	"	—	—
May 15	—	—	12.2	11.5	1.47	—	480	"	80	5,693
June 8	—	—	13.0	12.6	1.43	—	520	"	80	6,234
Plant "C"					Coke					Water Gas
April 10	—	—	3.70	4.32	.64	.80	115	No	80	2,270
May 16	—	—	4.57	3.86	.64	.80	95	"	81	2,270
June 3	—	—	5.67	4.25	.64	.80	105	"	90	2,270
Plant "C"					Coal				Coke	Oven Gas
June 20	—	—	6.65	5.26	.75	—	200	No	100	3,666
" 21	—	—	8.99	8.42	.75	—	210	"	97	3,666
Plant "D"										Water Gas
April	—	—	11.53	5.42	.647	1.40	110	—	—	—
Plant "A"										Mixed Gas
			In Lt. Oil Scrub-bers	Out Lt. Oil Scrub-bers	Proportion of Coal to	Water Gas				
Feb. 19			18.0	16.6	57	43				
April 9			12.3	10.3	61	39				
May 17			8.5	8.0	54	46				
June 19			16.1	18.2	62	38				

The principal fact brought out by this survey is that the organic sulphur in all the plants studied was always less than 30 grains per 100 cubic feet. In most cases it was very considerably less than this. This corroborates the results obtained last year. In general, the conclusions arrived at after last year's survey are strengthened by this year's committee work.

The results obtained from the tests on comparatively fresh oxide seem to show that greater removal of organic sulphur is obtained in the boxes than with oxide which has been in use for some time. Also, in boxes which are very nearly fouled, the gas has a tendency to pick up organic sulphur. As a general rule, however, the organic sulphur content of gas does not change appreciably while going through the boxes.

In going through the absorber of the Seaboard liquid purification process, no significant change in the organic sulphur content takes place. This bears out previous observations. Another point of interest is that the mixed gas, the last one listed in the table, shows no change in the organic sulphur content after passing through the light oil scrubbers. Scrubbing of the gas by paraffine oil is practiced by some plants to decrease the organic sulphur, but apparently in this case the organic sulphur content of the gas is so low or some other condition is different which prevents such results.

There seems to be no very constant relationship between the amount of sulphur in the coal or coke or the gas oil and the organic sulphur in the gas. It is difficult to judge as to the relative effects of the coke and the gas oil in contributing organic sulphur to water gas, since comparisons must be made between different plants. In general, however, it appears that both will contribute to the organic sulphur.

In conclusion, the principal fact brought out by this survey is that organic sulphur in gas practically never exceeds the legal limit of 30 grains per 100 cubic feet. Under normal operating conditions and with the use of raw materials of normal sulphur content, it is doubtful whether this limit would ever be exceeded. The organic sulphur is not decreased to any appreciable extent while the gas is passing through the condensing, scrubbing and purifying system. The only notable exception to this is that fresh oxide will absorb some organic sulphur.

Appendix B

THE REMOVAL OF ORGANIC SULPHUR FROM GAS

By Alfred R. Powell

Forms of Sulphur in Gas:

Gas Purification has nearly always been considered as synonymous with hydrogen sulphide removal, but as coal and gas oil of increasing sulphur contents are used for the manufacture of gas, the other sulphur compounds must demand some attention. This problem has been considered by the Purification Committee during this year, and it appears to be of sufficient importance to present a brief review of processes designed to remove "organic sulphur" from gas, with special attention to processes worked out in this country and those particularly applicable to American gas practice.

The term "organic sulphur" as applied to gas is generally used to designate all forms of sulphur other than hydrogen sulphide. As a matter of fact, carbon disulphide is the only sulphur compound other than hydrogen sulphide which occurs in comparatively large quantities, so that for all practical purposes the "organic sulphur" may be considered to be carbon disulphide. The small quantities of other organic sulphur compounds may be neglected from a quantitative standpoint.

In the majority of states where legislation has been passed regulating the quantity of total sulphur in gas, 30 grains per 100 cu. ft. has been set as the maximum. Assuming almost complete removal of hydrogen sulphide, the finished gas must always contain less than 30 grains of organic sulphur in order to conform to the legal specifications. At the present time, the organic sulphur content of the gas in most cities is well below this maximum, as shown by the survey of several representative companies described and tabulated elsewhere in this report.

In several instances, however, organic sulphur has exceeded the maximum legal limit. This has provided the incentive to investigate methods for decreasing the organic sulphur in gas, and, in several cases, investigations have been carried on with the purpose of anticipating any organic sulphur troubles which might develop at a later date.

Conditions Leading to Formation of Carbon Disulphide in Gas

That carbon disulphide is not a primary distillation product of coal has been demonstrated in several ways. The mere fact that it is not found in gas from low temperature carbonization and that it is lower in vertical retort gas than in the gas from horizontal retorts, is sufficient to show that carbon disulphide results from secondary reactions after the gas is formed. Experiments have shown that gas containing hydrogen sulphide will

react with incandescent carbon to form carbon disulphide up to a certain equilibrium concentration. The prescence of carbon disulphide in gas is, therefore, probably due to the reaction of hydrogen sulphide with incandescent carbon as the gas passes out of the retort.

In the case of water gas, a certain amount of carbon disulphide must be formed in the generator, since here we have conditions favoring its formation as the blue gas passes through the incandescent coke. The amount formed would be rather small, however, since the percentage of hydrogen sulphide is low and the percentage of hydrogen is rather high.

As to the formation of carbon disulphide in the carburetor, some interesting experiments along this line have been carried on by Stone and Webster in connection with the design of the Fall River gas plant.[1] Quoting from the paper describing this plant, the following statement is made.

"When using a high coke oil, a large part of the coke is deposited on the checker brick. During the run in which it is deposited, the coke is too cool to react with the hydrogen sulphide. If permitted to remain, however, it becomes incandescent during the succeeding blow and on the following run is active in the formation of carbon disulphide. It is, therefore, apparent that the only way to keep the fixed sulphur compounds down is to clean the coke from the carburetor after every run. In this manner the brick is clean at the beginning of each run and the hydrogen sulphide which is formed in the primary sulphur reaction cannot be reduced to carbon disulphide."

At this plant a connection has been made which "enables the generator to be isolated from the carburetor so that air may be admitted under the generator grate and to the top of the carburetor at the same time, the generator blast heating the fuel bed while the carburetor air consumes the carbon on the checker brick, thereby heating the brick."

It will be interesting to follow the results obtained from this type of installation as applied to the use of heavy, high sulphur gas oil. Without much doubt the organic sulphur problem in carburetted water gas manufacture will be affected more by the type of oil than by the coal or coke used. It does not require much argument to prove that practical methods for preventing the formation of undesirable constituents are preferable to methods for removal after they have been formed.

Processes for Removing Organic Sulphur from Gas

Various processes have been designed for the partial removal of organic sulphur from gas. No method has yet been devised which will completely remove organic sulphur, and it is very doubtful whether such a method is necessary, since part removal will decrease a high fixed sulphur content to within the legal limit.

The methods used for the removal of organic sulphur may be classed in four groups, (1) hot purification, of which there are several different processes, (2) washing by oil, (3) alkalinated cellulose, and (4) charcoal or other absorbent material.

(1) *Hot purification.* Hot purification is generally dependent on the following reactions:

$$CS_2 + 2H_2 = 2H_2S + C.$$

[1]A. C. Klein, A. G. A. Monthly, Vol. 5, pp. 183-91, 1923.

It can readily be seen that this reaction is the exact reverse of that reaction which leads to the formation of carbon disulphide. The conditions must, therefore, be carefully regulated in order to obtain the maximum conversion of carbon disulphide into hydrogen sulphide. In general the temperature must be high enough to cause the conversion to take place at a reasonable rate and yet not high enough to cause the reaction to reverse.

The hot purification of gas on a commercial scale was first carried out at Portland, Oregon.[2] The apparatus consisted of two vessels constructed much like water gas carburetors. While the checker brick in one vessel was being heated by producer gas to bring it to the necessary temperature, the other vessel, already hot, was purifying the gas passing through it. The hydrogen sulphide formed was removed by iron oxide. By using a temperature of 1200°F. about 70 per cent of the organic sulphur could be removed. The total cost of the process at that time was about one cent per 1000 cubic feet of gas.

This process was designed primarily for oil gas purification, but it was intended that the same principle could be applied to coal gas or water gas. Mr. E. L. Hall, General Superintendent of the Portland Gas and Coke Company, later took out a patent on an apparatus for the conversion of organic sulphur into hydrogen sulphide by means of a silent electric discharge, which was intended to supplant the hot purification. This was abandoned, however, and at the present time this company is changing over to an oil washing process. The advantages claimed for the oil washing process will be stated later.

The hot purification process just described depends solely on the effect of temperature to secure conversion of the carbon disulphide into hydrogen sulphide. Several other processes have been devised which make use of catalytic material to promote this conversion and are thereby enabled to operate at lower temperatures.

One of the best known of these is the so-called Carpenter-Evans process.[3] The gas to be treated is heated to about 800° F., and is then passed over fire clay balls impregnated with nickel. The nickel catalyses the conversion of carbon disulphide into hydrogen sulphide, thus allowing a much lower working temperature. The catalyst soon becomes coated with carbon, so that it is necessary to burn this out at certain intervals.

The percentage of organic sulphur which can be removed by this process is said to be in the neighborhood of 70-80 per cent. The latest cost figures from England indicate that the cost of purification by the Carpenter-Evans process is about 1½ cents per 1000 cubic feet.

Another process somewhat similar to that of Carpenter and Evans, is the Rideal-Taylor process.[4] In this latter process, however, hydrogen is not used to secure the decomposition, but steam is introduced with the gas to cause the decomposition of carbon disulphide according to the following reaction.

$$CS_2 + 2H_2O = 2H_2S + CO_2$$

This is quite a decided advantage over the Carpenter-Evans process in that no

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[2]H. M. Pabst, Amer. Gas Light Jour., Vol. 94, pp. 407-10, 1911; Jour. Gas Lighting, Vol. 113, p. 906, 1911; Gas World, Vol. 58, p. 210, 1913.

[3]C. C. Carpenter, Jour. Gas Lighting, Vol. 122, p. 1010, 1913; Vol. 123, pp. 30-33, 1913; Vol. 126, pp. 928-38, 1914. Gas World, Vol. 60, pp. 39-40, 863-72, 1914. E. V. Evans, Jour. Soc. Chem. Ind., Vol. 34, pp. 9-14, 1915.

[4]E. K. Rideal and H. S. Taylor, British Patent 130, 654, March 2, 1918.

carbon is deposited which must later be burned out. Furthermore, the catalyst is somewhat cheaper in this process, since it consists simply of iron oxide mixed with a small amount of chromium oxide. However, no practical plant cost figures are available for the Rideal-Taylor process.

Several years ago, W. H. Fulweiler described a hot purification system used at Harrisburg.[5] The catalyst in this case was a very active iron oxide and the temperature used was about 450°F. The gas was preheated to this temperature after the hydrogen sulphide had been removed and before passing through the catalysing material. Gas containing about 40 grains of fixed sulphur was reduced to 9 grains. No cost figures have been given for this process.

(2) *Washing by oil.* Within recent years a system has successfully been inaugurated at Halifax for decreasing the organic sulphur in gas.[6] The process depends on the fact that 50 per cent or more of the organic sulphur may be removed from the gas by washing with paraffin oil. The oil may then be put in condition for further use by distilling out the dissolved carbon disulphide with steam.

The apparatus consists of a series of three steel towers filled with wooden grids. Fresh oil enters the last tower of the series and flows from this to the other two towers successively. The fouled oil from the first tower of the series is steam distilled in a tar still at a low temperature to remove the carbon disulphide.

Mr. Hamilton has very kindly furnished the committee the following comments on the process, based on recent experience.

"Our experience has shown that the oil temperature should not be under 50° or over 60°F., and that in so far as possible the temperature of the oil should be maintained 1° or 2° below that of the gas with which it comes in contact. We have been able to accomplish that here by installing cooling coils between each of the three towers that we are using for oil scrubbing.

"The best reduction in sulphur for the least amount of oil appears to take place when we are using from eight to ten gallons of oil per 1000 cu. ft. of gas. We have also found that the method of handling the oil during its redistillation has considerable effect upon its absorptive capacity. Our experience has led us to believe that it is not best to attempt to strip all of the benzol from the oil during the redistillation process. We are now operating in such a way that we remove about 50% of the total benzol content of the oil at each distillation. With this benzol is driven off the major portion of the carbon bisulphide.

"These points cover our experience extending over three years of practically continuous operation with this system of purification. With twenty-four hour operation and careful temperature control it is possible to make reduction to approximately 50% of the organic sulphur present in the gas."

The Portland Gas and Coke Company has recently established a new process of oil gas manufacture in which the production of light oil is a prime consideration. Under these conditions they have found it profitable to establish an oil washing process for the double purpose of removing the light oil as well as the carbon disulphide. This is replacing the hot

[5] W. H. Fulweiler, A. G. A. Monthly, Vol. 1, p. 184, 1919.
[6] E. R. Hamilton, Gas Record, Vol. 18, p. 11, 1920; Amer. Gas Eng. Jour. Vol. 113, pp. 202-4, 1920.

purification process originally used at Portland for the removal of organic sulphur.

Mr. E. L. Hall has the following to say regarding the advantage of this method:

"The removal of organic sulphur by this means is so closely associated with the methods and benefits derived from the recovery of light oil that it is practically inadvisable to undertake one without the other. A great many plants formerly producing light oil have not considered it profitable to do so under post war conditions, and I am convinced that the future will bring back a revival of this phase of by-product recovery, principally on account of the associated benefits, which I may enumerate as follows:

1. "Removal of benzol for sale as motor fuel or otherwise. An operation which is more or less self-sustained and the profits of which are essential towards defraying the cost of oil washing with a suitable oil, which has necessarily to be steam distilled.

2. "The removal of naphthalene, which is accomplished at no extra expense.

3. "The removal of 75% of the organic sulphur, which from present indications is entirely feasible.

4. "The elimination from the gas of certain hydrocarbons causing a gummy deposition on the meter valves.

"All of these advantages if properly weighed should bring about benefits sufficient to favor the benzol recovery, and it is my conviction that the organic sulphur will eventually be handled by this means, rather than by any other with which I am acquainted."

(3) *Alkalinated cellulose.* The use of alkalinated cellulose for the removal of carbon disulphide from gas is often referred to as the "Athion" process.[7] The alkalinated cellulose is made by treating cellulose sulphite with soda lye. This material is spread on purifier grids, and the gas, free of hydrogen sulphide and carbon dioxide is passed through it. Removal of the carbon dioxide from the gas is affected by passing the gas through potassium carbonate before it goes through the alkalinated cellulose. The fouled material is essentially viscose which finds use in the manufacture of artificial silk, celluloid, etc. The inventors claim that alkalinated cellulose will cause a reduction in organic sulphur compounds of 75%, and that ten tons of the material will absorb 1¼ tons of carbon disulphide.

It is very improbable that this process will find use in this country. The necessity for removal of the carbon dioxide is a big factor, and would probably make the cost prohibitive without any further costs. The purifying material itself would be expensive, and it is very doubtful whether the quality of the by-product, viscose, would be high enough to offset any of the costs.

(4) *Charcoal or other absorbent material.* Charcoal will absorb approximately 65 volumes of sulphur compounds from gas, whereas the volume of other gas constituents absorbed is much smaller. Gordon Adams[8] has patented a process based on this fact. After the gas has passed the boxes it goes through animal or wood charcoal in a granulated form. The quantity of charcoal used must be just sufficient to be saturated with sulphur compounds and naphthalene

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[7]Jour. Gas Lighting, Vol. 119, p. 562, 1912. T. Kuckuk, Jour. Gas Lighting, Vol. 123, p. 34, 1913. Knoevengel, Jour. Gasbel, Vol. 56, pp. 757-60. 1913.
[8]British Patent 127, 431, 1919.

and not too large a quantity since this leads to excessive loss of unsaturated hydrocarbons. This will vary to a considerable extent but 70 lbs. of charcoal per ton of coal carbonized has been taken as a figure representative of coal gas. The charcoal is regenerated for further use by heating to about 300°C. No practical operating tests of the absorbent method for removing carbon disulphide from gas have been carried out in this country.

Summary and Conclusions:

1. Although the organic sulphur in manufactured gas generally is well below the legal limit, in some cases this limit has been exceeded. As coal and gas oil of higher sulphur contents are used, it may be necessary for gas companies to adopt means for decreasing this constituent.

2. The organic or fixed sulphur of gas consists very largely of carbon disulphide, and any process designed to decrease organic sulphur must be so arranged as to remove this constituent.

3. In the case of carburetted water gas, one American plant using high sulphur gas oil has been designed to handle the organic sulphur problem by burning out the carbon deposited in the carburetor at frequent intervals. Since carbon disulphide is formed by the action of hydrogen sulphide on incandescent carbon, this procedure should be a step in the right direction.

4. Several hot purification methods have been developed on a practical scale, both in this country and in England for the purpose of reconverting the organic sulphur of the gas into hydrogen sulphide, which may then be removed by ordinary methods. Among the outstanding processes of this type are the Oregon process, which uses hot checker brick, the U. G. I. Process developed at Harrisburg, which uses active iron oxide at a temperature of about 450°F., the Carpenter-Evans process, which uses nickel at a temperature of about 800°F., and the Rideal-Taylor process, which uses steam and a catalyst composed of iron oxide and chromium oxide.

5. An oil washing process has been developed at Halifax, which has given satisfactory results for the conditions existing there over a period of three years. Also an oil washing process is being installed at Portland, Oregon, for use on oil gas.

6. Several other processes of rather doubtful commercial application have been developed in other countries. These have been briefly described in this report.

A. C. Fieldner: With your leave I will defer the discussion on the Purification Committee's report until after the presentation of the paper by Mr. F. W. Sperr, Jr., Chief Chemist of the Koppers Company, on "Progress in Liquid Purification."

PROGRESS IN LIQUID PURIFICATION

F. W. Sperr, Jr., Chief Chemist, The Koppers Company, Pittsburgh, Pa.

At the 1921 meeting of the American Gas Association, the writer had the privilege of describing the Seaboard Liquid Process of Gas Purification which had been developed by The Koppers Company.* The new apparatus, treating all of the gas produced by the Seaboard By-Product Coke Company, had then been in operation for only a few weeks, and it was impossible to give more than the preliminary results of practical operation. So much has subsequently been accomplished in the further introduction and development of this process and in its application to many gas works, operating under a variety of conditions, that it has been thought desirable to offer to the Association a report on the progress made.

Table 1 gives a list of liquid purification plants, installed or licensed by The Koppers Company up to September 1st, 1923. That within two years from the time when the first complete large scale apparatus was put into operation, nearly thirty gas plants have adopted the system, is impressive testimony to the alertness of the gas industry in taking advantage of improvements in its essential processes. The list in Table 1 comprises 7 plants treating gas from coke or gas ovens, 1 plant treating gas from horizontal retorts, 1 plant treating gas from vertical retorts, 5 plants treating a mixture of water gas with coal gas from horizontal or inclined retorts or verticals, 7 plants treating straight water gas, and 5 plants treating California oil gas. The plant capacities range from 2,000,000 to 30,000,000 cu. ft. per 24 hours, and the total capacity of all the plants is 232,500,000 cu. ft. per day. Never before has liquid purification been employed on so large a scale or under such varied conditions. In general, it can be stated that the results obtained have confirmed or improved upon the statements made in the writer's previous paper, and that while various problems have arisen, as would naturally be expected in the development of any new process, no insurmountable difficulty has been encountered.

Operation

Reviewing the process briefly, it will be recalled that the gas to be purified is passed into a scrubbing chamber, called the absorber, filled with suitable packing material, over which a dilute solution of sodium carbonate is sprayed. This solution removes about 90 per cent of the hydrogen sulphide and nearly all

*Technical Section A. G. A. Vol. 3, (1921) p. 282 and A. G. A. Monthly Vol. 4, (1922) p. 243. A list of subsequent articles in the Koppers Company's Process is given at the end of this paper.

TABLE 1

LIQUID PURIFICATION PLANTS IN OPERATION OR UNDER CONSTRUCTION TO SEPTEMBER 1, 1923

The Koppers Company, Pittsburgh, Pa.

Name of Company	Location of Plant	Capacity of Plant	Kind of Gas
*Seaboard By-Product Coke Co.	Jersey City, N. J.	25,000 M cu.ft.	Coke Oven Gas
*Battle Creek Gas Company	Battle Creek, Mich.	2,000 M "	Coal Gas** and Water Gas
*Pacific Gas and Electric Co.	Oakland, California	30,000 M "	Oil Gas
Pacific Gas and Electric Co.	San Francisco, Calif.	30,000 M "	Oil Gas
Pacific Gas and Electric Co.	San Jose, California	5,000 M "	Oil Gas
Pacific Gas and Electric Co.	Fresno, California	5,000 M "	Oil Gas
*Pacific Gas and Electric Co.	Sacramento, Calif.	5,000 M "	Oil Gas
*Rochester Gas and Electric Corp.	Rochester, N. Y.	6,000 M "	Vertical Retort Gas
*Pittsburgh Crucible Steel Co.	Midland, Pa.	12,000 M "	Coke Oven Gas
*Wisconsin Gas and Electric Co.	Racine, Wisconsin	3,000 M "	Horizontal Retort Gas
*Indiana Coke and Gas Corporation	Terre Haute, Indiana	3,000 M "	Coke Oven Gas
*Meriden Gas Light Company	Meriden, Connecticut	2,000 M "	Vertical Retort and Water Gas
*Allentown-Bethlehem Gas Co.	Bethlehem, Pa.	10,000 M "	Coke Oven Gas
Denver Gas and Electric Co.	Denver, Colorado	12,000 M "	Water Gas
Boston Consolidated Gas Co.	Boston, Mass.	5,000 M "	Water Gas
Consumers Power Company	Flint, Michigan	5,000 M "	Water Gas and Retort Gas
Troy Gas Company	Troy, New York	2,500 M "	Water Gas
Manchester Gas Co.	Manchester, N. H.	2,500 M "	Vertical Retort and Water Gas
Milwaukee Gas Light Co.	Milwaukee, Wisconsin	10,000 M "	Coke Oven Gas
Municipal Gas Company	Albany, New York	4,000 M "	Water Gas
Elmira Water, Light and R. R. Co.	Elmira, New York	2,500 M "	Water Gas
Consumers Power Company	Zilwaukee, Michigan	3,000 M "	Gas Oven Gas
Consolidated Gas, Elec. Lt. and Pr. Co.	Baltimore, Maryland	24,000 M "	Coke Oven Gas
Louisville Gas and Electric Co.	Louisville, Kentucky	12,000 M "	Water Gas
Minneapolis Gas Light Co.	Minneapolis, Minn.	10,000 M "	Water Gas and Retort Gas
Binghamton Gas Company	Binghamton, New York	2,000 M "	Water Gas

*In operation. **Inclined chambers.

Fig. 1.—Liquid Purification Apparatus—Allentown-Bethlehem Gas Company, Bethlehem, Pa.

of the hydrocyanic acid. The last traces of hydrogen sulphide are removed in iron oxide catch boxes. The solution with the absorbed impurities, emerging from the absorber, passes into a second chamber, called the actifier, and is sprayed over similar packing material. Air blown into the actifier removes the absorbed impurities and regenerates the solution so that it can be used over again in the absorber. The circulation of the solution is continuous. A discussion of the apparatus will follow in a later section of this paper.

The Seaboard Plant

The liquid purification plant of the Seaboard By-Product Coke Company has been in continuous operation for two years, treating all of the gas produced by this company, which, during the greater part of this period, has averaged 24,000,000 cu. ft. per day. The two present absorbers were used during the preceding year for partial purification, one being then employed as an absorber and the other as an actifier. They were originally built as benzol scrubbers and were used for this purpose for three years preceding their conversion, so that this part of the apparatus is six years old and has been used for liquid purification for three years continuously, with only a few days intermission during the entire period. The original wooden hurdles are still in service and were inspected a few months ago and found to be in good condition. The apparatus as a whole is in good condition and shows no signs of undue corrosion.

The Seaboard plant is dependent on liquid purification to such an extent that, if the system were shut down, the oxide boxes would be incapable of handling more than half of the gas, and could not, in their present arrangement in pairs, handle this much for any length of time. On the other hand, since the gas entering these boxes contains very little hydrogen sulphide, the oxide in the last box of each pair is always relatively fresh. The liquid purification system has two absorbers and two actifiers operating in parallel. If at any time it is necessary to shut down any one of these, the rest of the system can be kept in operation and the circulation increased over the absorber or actifier which is not shut down. In this way, 70 to 75 per cent of the hydrogen sulphide will still be removed by liquid purification and the catch boxes will readily remove the remainder during the relatively brief periods required. It speaks well for the adequacy of the process in continuous operation that the Seaboard plant operating during the past two years under all sorts of conditions, with periods of abnormally high sulphur and other periods of unusual naphthalene difficulties, has not at any time failed to deliver its entire gas production properly purified.

The necessity of shutting down an absorber has seldom occurred and has in each case been due to the necessity of steaming out naphthalene. This naphthalene is supposed to be removed in the final cooler, which is part of the regular equipment of every direct process coke plant, and in which the gas is cooled by scrubbing with water which carries the naphthalene away mechanically. The final cooler originally installed was too small for the increased gas output of the plant, and has been replaced, this year, by a larger one. Even with the latter, however, the plant must contend with periods of high water temperature, so that the liquid purification apparatus, both before and after the new cooler was installed, has

had to play the part of gas cooler and naphthalene remover in addition to its regular functions.

The principal operating history of the Seaboard liquid purification system is shown graphically in Figure 2. The most striking feature is the lowest line, taken in relation to the lines indicating the volume of gas treated and the hydrogen sulphide in the inlet gas. This shows how well the process takes care of variations in the amount of gas treated and of extraordinary fluctuations in the hydrogen sulphide content of the gas. The special value of the process in dealing with conditions arising from the employment of high sulphur coals is shown in the period August to November 1922. When the railroad strike began in conjunction with the coal strike in the summer of 1922, the Seaboard plant found it necessary to relieve the coal shortage by importing coal from England. This coal was high in sulphur, and caused the hydrogen sulphide in the gas to run at times over 900 grains per 100 cu. ft. but its use was absolutely necessary to keep the plant in operation. Had the plant possessed ordinary oxide box equipment for its entire gas output, serious trouble would certainly have occurred; but with the liquid purification system the excess hydrogen sulphide was readily removed, and that in the outlet gas did not in any case exceed the capacity of the catch boxes.

The work of the catch boxes was relieved to some extent by the installation of a trial system in which one box was used for complete soda purification without oxide. This will be described in a later section of this paper. This trial system was discontinued the latter part of November and the oxide catch boxes handled the gas from the liquid purification apparatus satisfactorily, although, for some time this gas continued to have about the same hydrogen sulphide content as during the period above described.

Apart from conditions due to the production of high sulphur gas, the consumption of soda has been higher than normal during the winter months. During the last half of October, 1921, a 5 per cent solution was used, during the rest of the time the regular 3 per cent solution has been employed, except during the period when English coal was used when the strength was increased to 4 per cent. The Seaboard plant depends on direct steam to heat the solution going to the actifier during the winter. There is consequently a considerable condensation of moisture and when this becomes excessive, some of the solution has to be discarded, resulting in loss of soda. With this condition properly taken care of, the soda consumption should not exceed 0.05 pound per M. cu. ft. of gas.

General Operating Results

Some space has been given to the Seaboard plant in particular because the liquid purification system has been in operation there for a much longer time than anywhere else, and because it well illustrates the results that can be obtained over a long period by a plant dependent entirely on liquid purification. It will now be useful to discuss the results obtained at this and the other operating plants, classifying them under headings indicating advantages that have been demonstrated and various problems that have arisen.

Efficiency of H_2S Removal—Operating Results

When the development of liquid purification was first undertaken by the re-

search organization of The Koppers Company, it was hoped to develop a process capable of removing 60 to 70 per cent of the hydrogen sulphide from ordinary coal gas, for the purpose of reducing the investment, labor and ground space required by oxide boxes. This, doubtless, fairly represented the attitude of the gas industry toward liquid purification at that time. It is gratifying that the process actually developed has proven readily capable of removing more than 85 per cent of the hydrogen sulphide, and that the majority of the plants now in operation are taking out over 90 per cent before the catch boxes.

The Seaboard plant was planned to obtain 80 per cent efficiency in handling 25,000,000 cu. ft. of gas per 24 hours. In actual operation we obtained over 90 per cent. This has consequently been the ideal figure at which we have aimed in the design of subsequent plants. The unknown factor in planning the first new plant for the Battle Creek Gas Company was the size of the absorber, since the absorbers at Seaboard were benzol scrubbers of considerable excess capacity. The results showed that not quite enough surface had been provided in the Battle Creek absorber as filled with spiral tile, so part of these were taken out and replaced with ½ inch to 1 inch coke, which has more surface per cu. ft. This plant has a normal efficiency of approximately 90 per cent, treating 2,000,000 cu. ft. of gas per 24 hours. The gas is a mixture of coal gas and water gas and fluctuates greatly in rate of output and in content of hydrogen sulphide—the latter averaging about 310 grains per 100 cu. ft.

The next step was the design of apparatus in which coke was substituted for spiral tile throughout. Such apparatus was installed for the Rochester Gas and Electric Corporation, the sizes being computed from data obtained with an experimental coke-filled apparatus at Seaboard. The results obtained at Rochester were not quite as good as those indicated by the experiments, the normal operating efficiency being 82 per cent. Work is now under way to enlarge this apparatus and to substitute spiral tile for the coke.

The apparatus of the Pacific Gas and Electric Company for treating oil gas at their Oakland, California plant was filled with coke which had been shipped all the way from our Seaboard plant and which was in rather unsatisfactory condition on account of breakage in transit. This plant is treating 12,000,000 cu. ft. of gas per day and removing from 80 per cent to 85 per cent of H_2S. This gas contains 180 to 200 grains of H_2S per 100 cu. ft. and about 5 per cent of carbon dioxide and although the latter favors rapid actification it hinders efficient absorption. With such gas, improvement should result by increasing the ratio of the size of the absorber to that of the actifier.

The second liquid purification plant of the Pacific Gas and Electric Company at Sacramento, California was put into operation in June, 1923, with very satisfactory results. This apparatus is coke filled and is treating gas containing approximately 180 grains H_2S per 100 cu. ft. with an efficiency of 94 per cent—the outlet gas showing approximately 12 grains of H_2S. The gas rate fluctuates greatly, averaging 1,665,000 cu. ft. per day. Special tests have shown as high as 95 per cent efficiency at a rate of 3,000,000 cu. ft. per 24 hours.

Three other plants using coke pack-

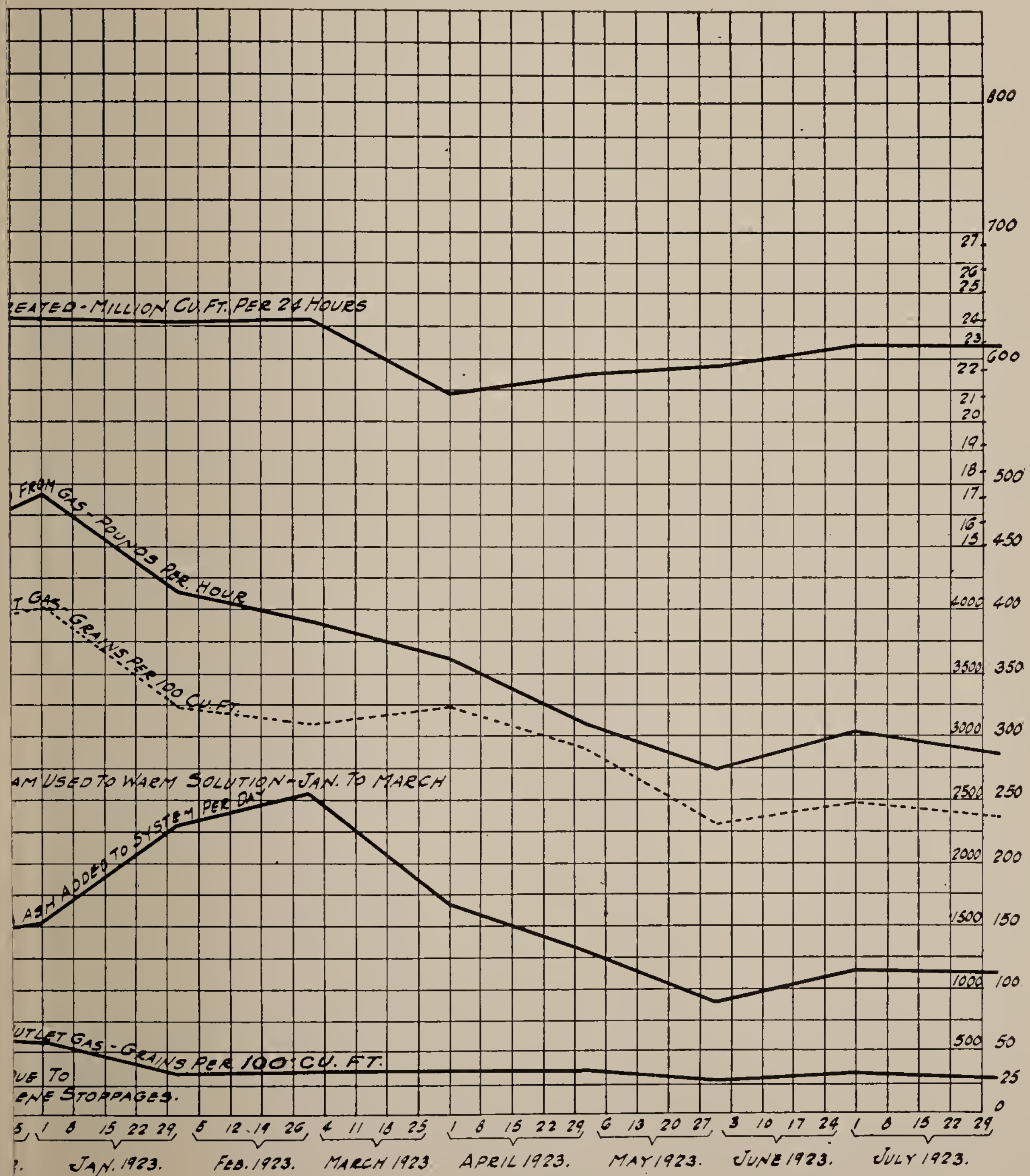
ing are in operation in the East at present writing. The plant at Racine, Wisconsin used a larger sized coke at the start and has found a material improvement in substituting smaller coke. It is now operating at an efficiency of approximately 82 per cent. The plant of the Allentown-Bethlehem Gas Co. at Allentown, Pennsylvania (Fig. 1) is operating with a normal sendout of 2,500,000 cu. ft. per 24 hours, removing 98.5 per cent of the hydrogen sulphide from gas containing 500 to 575 grains per 100 cu. ft. The efficiency at the maximum rate of 10,000,000 cu. ft. per 24 hours is 91 per cent. The plant of the Crucible Steel Co. at Midland, Pennsylvania is treating 10,000,000 to 11,000,000 cu. ft. of coke oven gas containing 400 to 580 grains H_2S per 100 cu. ft. and the records for the month of July show an efficiency of 90.7 per cent

The Indiana Coke and Gas Company, Terre Haute, Ind. has converted a former benzol scrubber into liquid purification apparatus, using wooden hurdles, and is obtaining an efficiency of 94.5 per cent at a gas rate of 1,500,000 cu. ft. per 24 hours. The inlet gas varies from 224 to 475 grains of H_2S per 100 cu. ft.

Operating records of the plant of the Allentown-Bethlehem Gas Co. for the month of June, 1923, are given in Table 2 to illustrate what can be accomplished in highly efficient hydrogen sulphide removal, by a high capacity plant operating at a moderate normal rate. This plant takes coke oven gas from the Bethlehem Steel Company at a usual rate of 2,000,000 cu. ft. per 24 hours; but at periods of a few hours duration may handle a rate of 10,000,000 cu. ft. per 24 hours. The plant was designed to handle the maximum rate at 90 per cent efficiency. The actifier fan is kept running full, and a high rate of circulation is maintained when operating at normal gas rates. This, of course, requires a power consumption much larger than ordinary, but it is considered that the benefits obtained in this case warrant the extra expense involved. Under these conditions excellent results have been obtained by using a more dilute solution when the lower gas rates are being handled. The apparatus is so large in proportion to the normal gas rate that a fairly high rate of circulation has to be employed to ensure good distribution. The soda content of the solution can then be reduced to 1 per cent with the advantage of reducing the consumption due to secondary reactions and mechanical losses. The strength is increased just prior to any period when the higher gas rates have to be handled.

Surface and Circulation

The matter of efficiency is primarily related to the design of the apparatus, and our experience has shown that, in this relation, the paramount consideration is the amount of contact surface in the absorber and actifier. The important subject of tower packing will be discussed in a later section of this paper, and the experiments described in the previous paper should be studied in this connection. Those experiments and subsequent experience have shown that with a given apparatus and using a 3 per cent soda solution with proper actification, the efficiency of hydrogen sulphide removal increases rapidly as the rate of circulation is increased up to about 50 gallons per M. cu. ft.; but that beyond this, a large increase of circulation produces only a small increase in efficiency. This is illustrated by Fig. 3 which shows the results of tests made at the Battle Creek plant. For a solution of any given strength there is a certain efficient rate of circulation,



EATED - MILLION CU. FT. PER 24 HOURS
FROM GAS - POUNDS PER HOUR
T GAS - GRAINS PER 100 CU. FT.
AM USED TO WARM SOLUTION - JAN. TO MARCH
ASH ADDED TO SYSTEM PER DAY
UTLET GAS - GRAINS PER 100 CU. FT.
UE TO
ENE STOPPAGES.
JAN. 1923.
FEB. 1923.
MARCH 1923
APRIL 1923.
MAY 1923.
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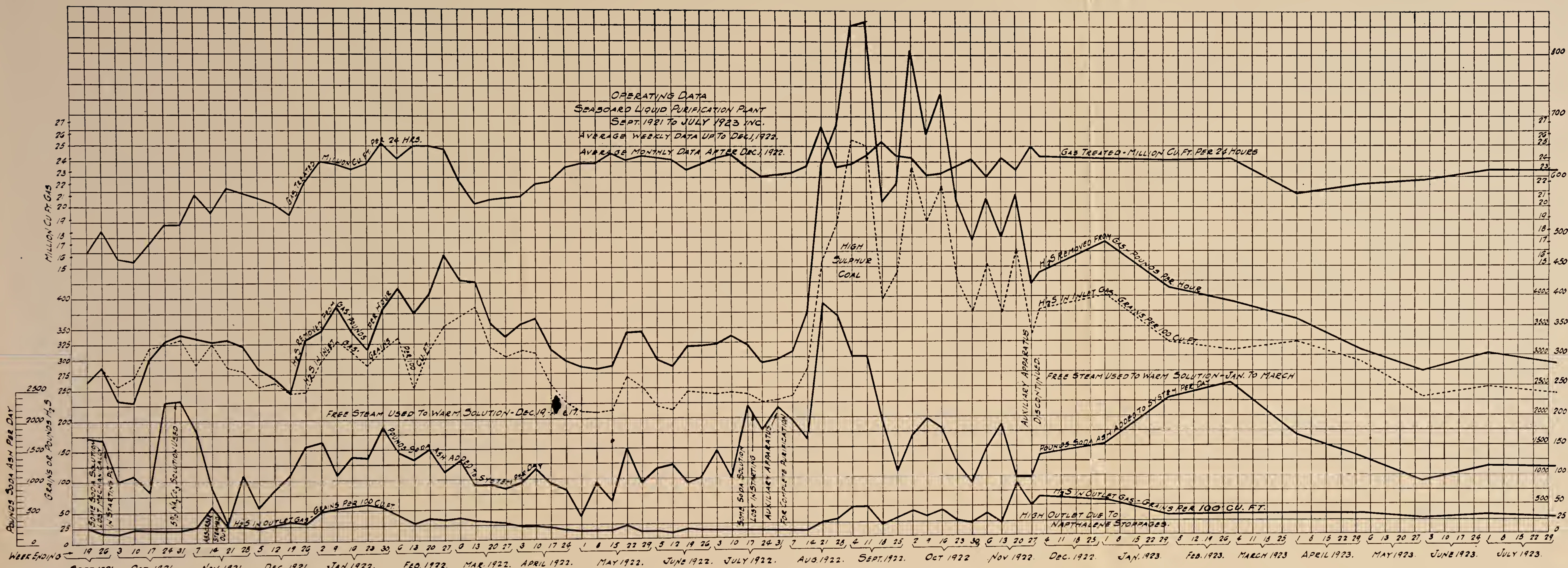

Fig. 2.—Operating History of the Seaboard Liquid Purification Plant.

TABLE 2

OPERATING DATA OF LIQUID PURIFICATION PLANT OF ALLENTOWN-BETHLEHEM GAS CO.—MONTH OF JUNE, 1923

Date		Gas Purified M cu. ft. a Day	Inlet H_2S Grains Per 100 Cu. Ft.	Outlet H_2S Grains Per 100 Cu. Ft.	% H_2S Removed	Lb. H_2S Removed	Solution Rate Gal. Per Hour	Solution Rate Gal. Per M	Solution Strength %	Lb. Na_2Co_3 Consumed Per Day	Lb. Na_2Co_3 Consumed Per M	Lb. Na_2Co_3 Consumed Per Lb. H_2S	Air Rate Cu. Ft. Per M
June	1	2764	548	7	98.7	2136	13000	112	2.10	273	0.098	0.128	9400
	2	3219	575	12	97.9	2598	13000	97	2.03	391	0.122	0.150	8000
	3	2476	550	5	99.1	1945	13000	126	2.01	241	0.097	0.124	10500
	4	2430	550	5	99.1	1892	13000	128	1.96	352	0.145	0.186	10700
	5	2377	570	10	98.3	1900	13000	131	1.90	123	0.052	0.065	10900
	6	2837	560	10	98.2	2227	13000	110	1.83	297	0.104	0.133	9100
	7	2300	575	8	98.2	1863	13000	135	1.89	276	0.120	0.150	11300
	8	2473	560	5	99.0	1961	13000	126	1.80	415	0.168	0.212	10500
	9	2927	538	7	98.7	2220	13000	106	1.84	172	0.059	0.077	8900
	10	2308	540	5	99.0	1780	13000	135	1.86	242	0.104	0.136	11200
	11	2610	553	7	98.8	2036	13000	119	1.60	316	0.121	0.152	9600
	12	2340	560	5	99.1	1667	13000	133	1.56	174	0.075	0.104	11100
	13	2554	558	10	98.2	1999	13000	122	1.62	259	0.102	0.130	10200
	14	2361	573	7	98.8	1909	13000	132	1.66	177	0.075	0.093	11000
	15	2435	542	8	98.1	1858	13000	128	1.73	130	0.053	0.070	10600
	16	3715	565	12	97.9	2935	12000	77	1.78	174	0.047	0.059	7000
	17	2300	545	5	99.0	1774	12000	125	1.70	.373	0.162	0.210	11300
	18	2481	523	5	99.0	1836	12000	116	1.46	236	0.095	0.128	10500
	19	2382	508	5	99.3	1712	12000	121	1.39	163	0.068	0.095	10900
	20	2549	545	5	99.0	1966	12000	113	1.26	226	0.089	0.115	10200
	21	2264	547	7	98.8	1746	12000	127	1.14	231	0.101	0.132	11400
	22	2364	513	5	99.0	1716	12000	122	1.13	117	0.050	0.068	10900
	23	2352	560	10	98.2	1850	12000	123	1.59	408	0.174	0.220	11000
	24	2310	550	5	99.1	1798	12000	125	1.48	104	0.045	0.057	11300
	25	2363	537	13	97.6	1796	11000	112	1.26	369	0.156	0.205	10900
	26	2310	537	5	99.1	1755	10000	104	1.15	257	0.112	0.146	11200
	27	2462	505	4	99.3	1765	11000	106	1.00	213	0.096	0.120	10500
	28	2311	520	29	94.4	1621	10000	104	0.980	85	0.037	0.052	12900
	29	2575	542	12	97.8	1950	11000	102	0.954	112	0.043	0.057	10660
	30	3445	545	7	98.6	2648	12000	84	0.842	153	0.044	0.058	7520
Total		76594				58859				7059			
Average		2553	546	8	98.5	1963	12276	117	1.55	235	0.0938	0.121	10300

Note: An air rate of 18,000 cu. ft. per minute was maintained throughout the month.

above which there is little advantage to be gained. This consideration, therefore, governs the design of the circulating system and the selection of pumps for any installation. In most cases, we provide for a circulation of 50 to 60 gallons of 3 per cent solution per M. cu. ft. at the gas rate decided upon.

Actification

The rate of air used for actification is approximately 2½ times the gas rate, and the efficiency of actification need not be so high as that of absorption. Actification sufficient to remove 80 per cent of the hydrogen sulphide from the fouled solution is ordinarily very satisfactory, and good results have been obtained at Seaboard at lower efficiencies. The fundamental consideration is, of course, not the percentage actification; but the tension of hydrogen sulphide in equilibrium with the actified solution; and the rule is that this must not be greater than the partial pressure of the hydrogen sulphide remaining in the gas at the absorption efficiency decided upon. The theory of actification

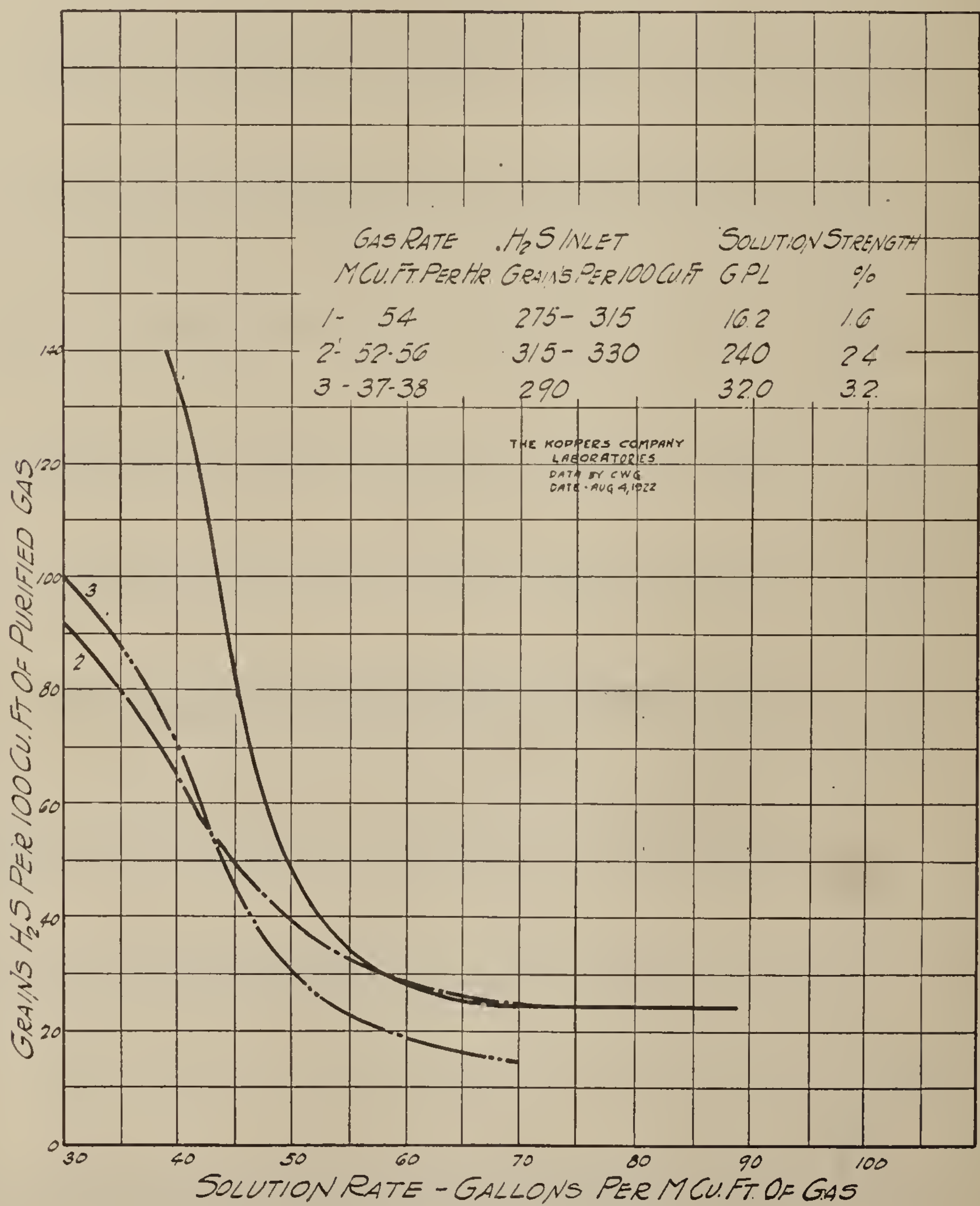

Fig. 3—Effect of Change in Solution on H_2S Content of Purified Gas.

has been worked out in considerable detail by our organization and some of the more important points have been discussed in the previous paper.

Efficiency and Gas Rates

With apparatus designed as indicated above, the practical question would occur—What efficiencies may be expected if the gas rate is increased above or decreased below that for which the apparatus was designed? The curve in Figure 4 gives an approximate idea of the results that can be obtained by operating a liquid purification plant with coal gas at different rates, it being assumed that there is no great variation in the hydrogen sulphide content of the gas. Experience has shown that such a plant will handle a 50 per cent overload at 75 per cent efficiency, and a 100 per cent overload at 60 to 65 per cent efficiency. For example, the Battle Creek plant, which was designed to remove 90 per cent of the hydrogen sulphide from 2,000,000 cu. ft. of gas per 24 hours has treated 3,000,000 cu. ft. per 24 hours, obtaining a removal of 75 per cent. Operating at less than the rated capacity one of two courses may be

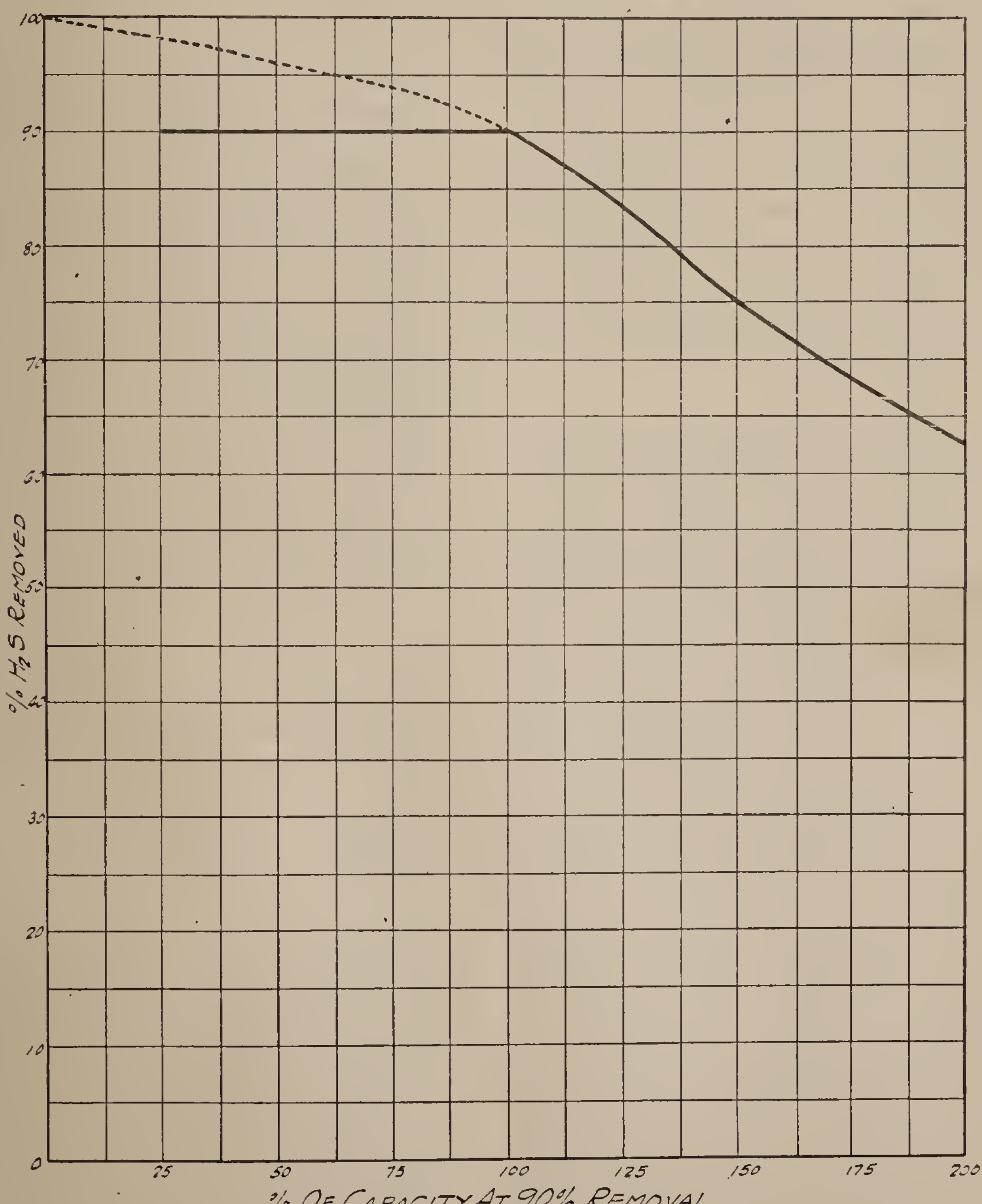

Fig. 4.—Relation of Efficiency to Gas Rate.

followed. (1) The speed of the pumps and fans may be reduced proportionally to the reduction in the gas rate so as to maintain 90 per cent efficiency. This is indicated by the solid black line. However, with this method of operation, a point may be reached at low gas rates at which the distribution of solution may become unsatisfactory. In this event, higher solution rates should be employed; but it will usually be advantageous to use more dilute solutions. (2) The pumps and fans may be kept operating at their normal rates while the gas rate decreases, in which case higher efficiencies will be obtained approximately as indicated by the dotted portion of the curve.

Should a plant be designed to operate at 90 per cent efficiency at the maximum gas rate, or at the normal or average gas rate? The answer will depend upon local conditions—the expected increase of demand, the duration of maximum sendout, the capacity of the catch boxes, etc. Where the maximum sendout is of only a few hours duration, and is much greater than the normal make, economy may be found in designing the liquid purification plant according to the normal or average make, but large enough so that the catch boxes will be adequate to handle the sulphur remaining in the gas during the periods of maximum sendout. Take, for example, the case of a plant normally producing 2,000,000 cu. ft. per day; but which, for periods of a few hours each week, makes 4,000,000 cu. ft. Assume the gas to contain 500 grains H_2S per 100 cu. ft. and the catch boxes capable of handling gas containing 200 grains at the 4,000,000 cu. ft. rate. The efficiency required at the maximum rate is $\frac{500-200}{500} = 60\%$, and apparatus capable of removing 90 per cent of the hydrogen sulphide at a rate of 2,000,000 cu. ft. per 24 hours should be ample for the purpose. In many cases the double unit system described under the head of *Apparatus*, should be very useful, especially in dealing with large seasonal variations in gas make.

Relation of Capacity and Efficiency to Hydrogen Sulphide Content of Gas

A special characteristic of the Seaboard process is its enormous reserve capacity with respect to hydrogen sulphide, which enables it to deal readily with gas containing amounts of this far above the normal, and which is one of its important points of advantage over ordinary oxide purification. A large increase in hydrogen sulphide in the inlet gas causes a relatively small increase in that in the outlet gas, even if the fans and pumps are kept running at a constant rate. It was stated in the previous paper that the outlet gas increases approximately 10 grains for each 100 grains increase above 300 grains per 100 cu. ft. in the inlet gas. In practice the actual increase in the outlet gas is lower than this and may be further reduced by using a little more soda in the solution. At Seaboard during the summer and fall of 1922, when the hydrogen sulphide rose from a normal amount of about 300 grains to more than 600 grains and, at times, more than 900 grains per 100 cu. ft., the strength of the solution was raised from 3 per cent to 4 per cent Na_2CO_3 and the rate of circulation increased 20 per cent. During the same period we were obliged to use the liquid purification apparatus as a gas cooler and for this purpose the spare fan was put into service, but tests showed that satisfactory hydrogen sulphide removal could have been obtained

without this. Throughout the worst of this period, the hydrogen sulphide in the catch boxes was kept well below 50 grains per 100 cu. ft. The soda consumption was not much higher than normal.

Both practical experience and experimental investigation indicate that the cost of treating gas containing 900 to 1000 grains of H_2S is very little more than that of treating gas containing one-third to one-half such amounts. Moreover the process may readily be applied to gas containing still larger amounts of hydrogen sulphide. With oxide purification, on the contrary, the cost of purification increases almost in direct proportion to the hydrogen sulphide content of the gas, and the higher the latter the more difficult does operation become. A system of oxide boxes is, of course, relatively inflexible and incapable of handling large overloads of sulphur.

The importance of these considerations is very great in view of the growing scarcity of low sulphur coal, which makes it inevitable that the hydrogen sulphide produced at the majority of gasworks will increase—not steadily and uniformly but with sudden rises which will be very difficult and often impossible to control with oxide purification. Liquid purification is soon likely to be regarded as indispensable in this situation and will in many cases earn returns far more than any direct saving in purification costs, through enabling gasworks to use lower priced high sulphur coals and to avoid paying high premiums on low sulphur coals.

Relation of Hydrogen Sulphide Content to Solution Rate and Strength

The rate of circulation required in the case of solutions containing 3 per cent, 5 per cent, and 7 per cent equivalent of Na_2CO_3 (i.e. 30, 50 and 70 g.p.l. respectively) to reduce the hydrogen sulphide of coal gas to a given amount has been investigated with the experimental apparatus at Seaboard and some of the principal results are summarized graphically in Figure 5. The 12 curves show the solution rates necessary to reduce the hydrogen sulphide to 25, 50, 75 and 100 grains with each strength of solution. While two or three of the curves show irregularities requiring further investigation, the results may be taken as fairly illustrative of the relations involved. The results obtained with the experimental apparatus on the lower sulphur gases have checked plant operation very well in regard to the solution rate required for various duties and although the actual circulation required in each case depends to some extent on the design of the apparatus it is believed that the general relations will hold good in all cases and that they will be approximately correct for higher sulphur gases.

The higher the strength of the solution, the more difficult it is to obtain good actification and in practice the solution should be kept as dilute as possible without requiring an unduly high rate of circulation. Low sulphur gases can be very advantageously treated with very dilute solutions and, even with gas containing 1000 grains H_2S per 100 cu. ft., it is undesirable to use a solution of more than 5 per cent alkalinity calculated as Na_2CO_3. Besides obtaining better actification, the use of dilute solutions minimizes secondary reactions and reduces mechanical losses of soda.

Removal of Hydrocyanic Acid

In tests made at the Seaboard plant,

the amount of hydrocyanic acid in the gas after liquid purification has been less than 1 grain per 100 cu. ft. Data obtained at other plants indicate that the efficiency of removal of the hydrocyanic acid is usually greater than that of the hydrogen sulphide. For example, a test made at one plant when operating with 66 per cent removal of hydrogen sulphide showed the hydrocyanic acid reduced from 20.6 grains to 3.24 grains —an efficiency of over 84 per cent. In

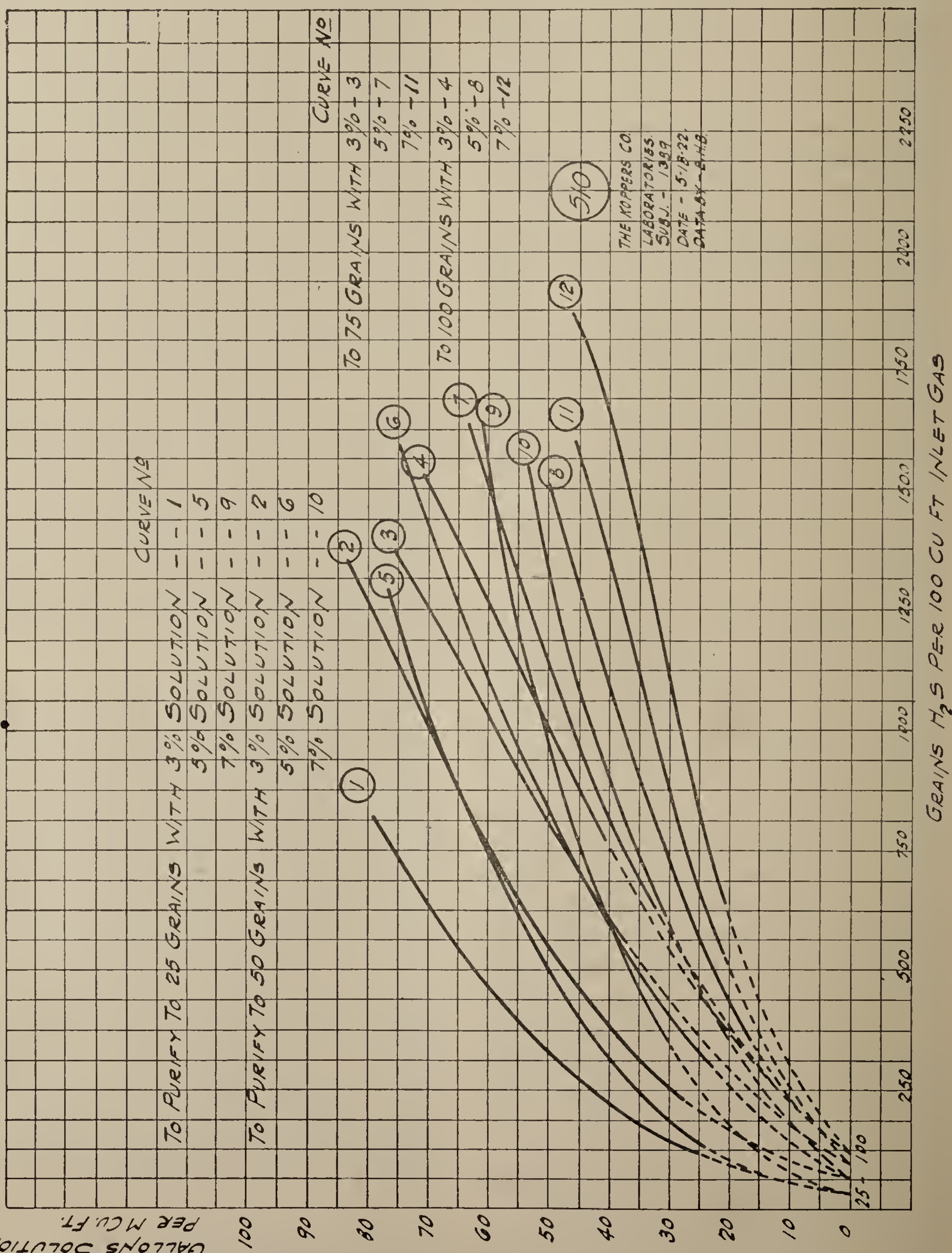

Fig. 5.—Solution Rate Required to Reduce Hydrogen Sulphide to Various Outlet Contents with 3%, 5% and 7% Solutions.

normal operation, the hydrocyanic acid is reduced to less than 2 grains per 100 cu. ft. and the amount in the outlet gas appears to be about the same irrespective of great variations in the inlet gas.

Recent tests at the Midland Plant of the Crucible Steel Company showed only 0.3 to 0.9 grains HCN in the outlet gas, with 15.1 to 17.3 grains per 100 cu. ft. in the inlet gas.

Advantages from Standpoint of Corrosion and Stoppages

The most definite improvement has been shown at Battle Creek where the trouble with meter deposits, which was formerly quite serious, has been completely eliminated with the advent of liquid purification. The work of many investigators, both in America and in England, has proven the importance of hydrocyanic acid as a cause of meter corrosion and of stoppages in meters and services, and there can be no doubt that there is a considerable saving in distribution costs due to its removal. The recent work of Dr. R. L. Brown, of the U. S. Bureau of Mines, which has been conducted under the auspices of this Association, indicates the desirability of eliminating oxygen as much as possible from the gas and that this element may be an important source of resinous stoppages as well as of corrosion. With liquid purification there is no necessity for admitting oxygen to the gas to accomplish continuous revivification in oxide boxes, and this source of difficulty may be reduced to a minimum.

Attendance and Maintenance

On account of its separate location, the Seaboard Liquid Purification Plant has required the services of one man per shift. It is seldom that there will be a labor charge against liquid purification in ordinary gasworks operation since the necessary attention can usually be given by men who would be required even if there were no gas purification at all. The only operations necessary are putting in soda, which is usually done once a day, giving the pumps and fans the usual attention and occasionally skimming tar from the sumps, cleaning the screens, etc. The simple tests of hydrogen sulphide in the inlet and outlet gas and of the alkalinity of the solution should be made daily. It is a good idea also to make periodical tests for hydrogen sulphide in the actified solution as a check on the performance of the actifier.

None of the plants have shown indications of any undue corrosion and repair costs have been low. Where continuous operation is important, spare pumps and fans are provided so that there should be little necessity of shutting down the system as a whole. With proper attention to keeping the solution clean and avoiding as much as possible the introduction of heavy tar and other foreign matter into the tower packing, the apparatus should continue in service for years without the necessity of cleaning. Undoubtedly more care will have to be exercised where coke packing is used than with apparatus provided with hurdles and spiral tile and the subject will be discussed further in this connection. During the past two years, the Seaboard Liquid Purification plant has been shut down only five times—the longest period being for 3 hours and the others from ¾ to 1½ hours. Two of the shutdowns were for minor alterations and three for inspection and repairs. Each of the two absorbers has been shut down twice for steaming or repairs.

Where much trouble from naphthalene

or tar is to be anticipated, it is well to consider the installation of a spare actifier or the double unit system described under the head of *Apparatus*.

With a single absorber and actifier short interruptions of the circulation may occur without interfering with purification beyond the capacity of the catch boxes because there is a considerable amount of soda solution adhering to the surfaces in the absorber and this has a large reserve capacity. The reserve capacity of the solution is so great that the fans may be shut down for considerable periods without interfering greatly with purification. Such capacity may be increased if desired by increasing the strength of the solution prior to shutdown periods. In one instance, the fan at the Battle Creek plant was shut down over night and the absorber was still removing 50 per cent of the H_2S the next morning without any actification beyond what could be effected by the natural draft through the tower.

Cold Weather Operation

The liquid purification system is a very efficient gas cooler and in the winter, unless provision is made for heating the solution or the air, will cool the gas to such an extent as to lower its heating value. Tests made at Seaboard showed that the gas should not be cooled to less than 7° C. (45° F.). At lower temperatures the heating value was seriously affected but at higher temperatures no injury occurred. Another result of excessive cooling is condensation of moisture in the gas which, under conditions of high atmospheric humidity or very low temperatures, results in accumulations of water in the solution to such an extent that some of this may have to be wasted. At Seaboard we have as yet had no special provision for heating the solution except the method of introducing direct steam. This is effective in preventing loss of heating value, but causes accumulations of water, loss of solution and high soda consumption during the winter months. At other plants we have installed heating coils in the circulating sumps. These, however, in the single tower apparatus, serve to warm the actified solution before it is pumped to the absorber, whereas better results would be obtained by warming the solution going from the absorber to the actifier. In some of the newer plants, now under construction, provision is made for accomplishing this by installing a Ross Heater in the line conveying the solution from the absorber to the actifier. At other plants, provision is also being made for heating the actifier air.

Bicarbonate Deposition

We have had a single instance of trouble on account of deposition of sodium bicarbonate. This occurred last winter at the Rochester plant—the material being deposited in a solid mass in the upper part of the coke packing of the actifier. When the nature of the trouble was ascertained, it was readily corrected by heating the solution to a high temperature and circulating this heated solution until the bicarbonate was dissolved. The trouble has not occurred again at Rochester and we have had no indications of it at any other plant; but an explanation will be given here so that its possible occurrence may be guarded against.

In the purification of coal gas, the actified solution contains sodium carbonate, sodium bicarbonate, sodium thiosulphate, sodium thiocyanate and a little sodium hydrosulphide. The fouled solution from the absorber contains the

same substances, the amount of sodium bicarbonate and sodium hydrosulphide being a little higher and some sodium cyanide being present in addition. Under normal conditions of operation, the amounts of the carbonate, bicarbonate, hydrosulphide and cyanide remain practically constant at any one point in the system. The sodium thiosulphate and thiocyanate are products of secondary reactions and so tend to accumulate and if there were absolutely no loss of solution from the system, they would continue to accumulate until crystallization would occur. These two substances are, however, among the most soluble salts known and since no system is perfectly free of losses, they merely accumulate until a point is reached when their rate of formation is balanced by the rate of loss.

Of the constituents of the solution, sodium bicarbonate is the least soluble and its solubility is still further reduced by the presence of the other salts. For example, at 20° C. a saturated solution of sodium bicarbonate and water contains 88 grams of the bicarbonate. If, however, the solution contains 66 grams per liter of sodium thiosulphate and the same amount of sodium thiocyanate, it can contain only 51 g.p.l. of sodium bicarbonate; and if it contains 133 g.p.l. of each of the other salts, it can contain only 26 g.p.l. of sodium bicarbonate.

Determination of Concentration Limits of Sodium Salts

Therefore, a condition may occur where there may be such an accumulation of sodium thiosulphate and thiocyanate as to cause precipitation of the sodium bicarbonate. Such a condition would be brought about by low mechanical loss, high carbon dioxide or hydrocyanic acid in the gas, or poor actification favoring secondary reactions and would occur more readily in cold solutions. If it should occur, the trouble can readily be forestalled by withdrawing some of the solution from the system and replacing it with fresh water, adding enough soda to keep the alkalinity constant. If any such condition is to be anticipated, occasional analyses of the solution will indicate whether the concentrations are approaching a point where precipitation of bicarbonate may occur. The chart shown in Figure 6 has been drawn so as to make it possible to predict the maximum permissible concentration of sodium salts (other than the bicarbonate) for any given bicarbonate concentration and any given solution temperature. To use this chart it is merely necessary to lay a straight edge between the appropriate temperature and bicarbonate concentration. The intersection of the straight edge with the added sodium ion scale gives directly the maximum concentration of added sodium ion equivalents permissible.

The concentrations are expressed in terms of 1000 grams of water, but the same scales may be used where the figures are in grams per liter. Thus, if the sodium bicarbonate concentration is known in grams per liter and read on the sodium bicarbonate scale, the added sodium ion equivalent is given in equivalents per liter.

The following example illustrates the use of the chart:

Given: Temperature 15°C.
Sodium bicarbonate, grams per liter 67.0
Permissible added sodium ion in equivalents per liter ... 0.52
(Found by connecting 15° C. and 67.0 and prolonging the straight edge to intersection with the added sodium ion scale).

Now if the added salt is sodium thio-

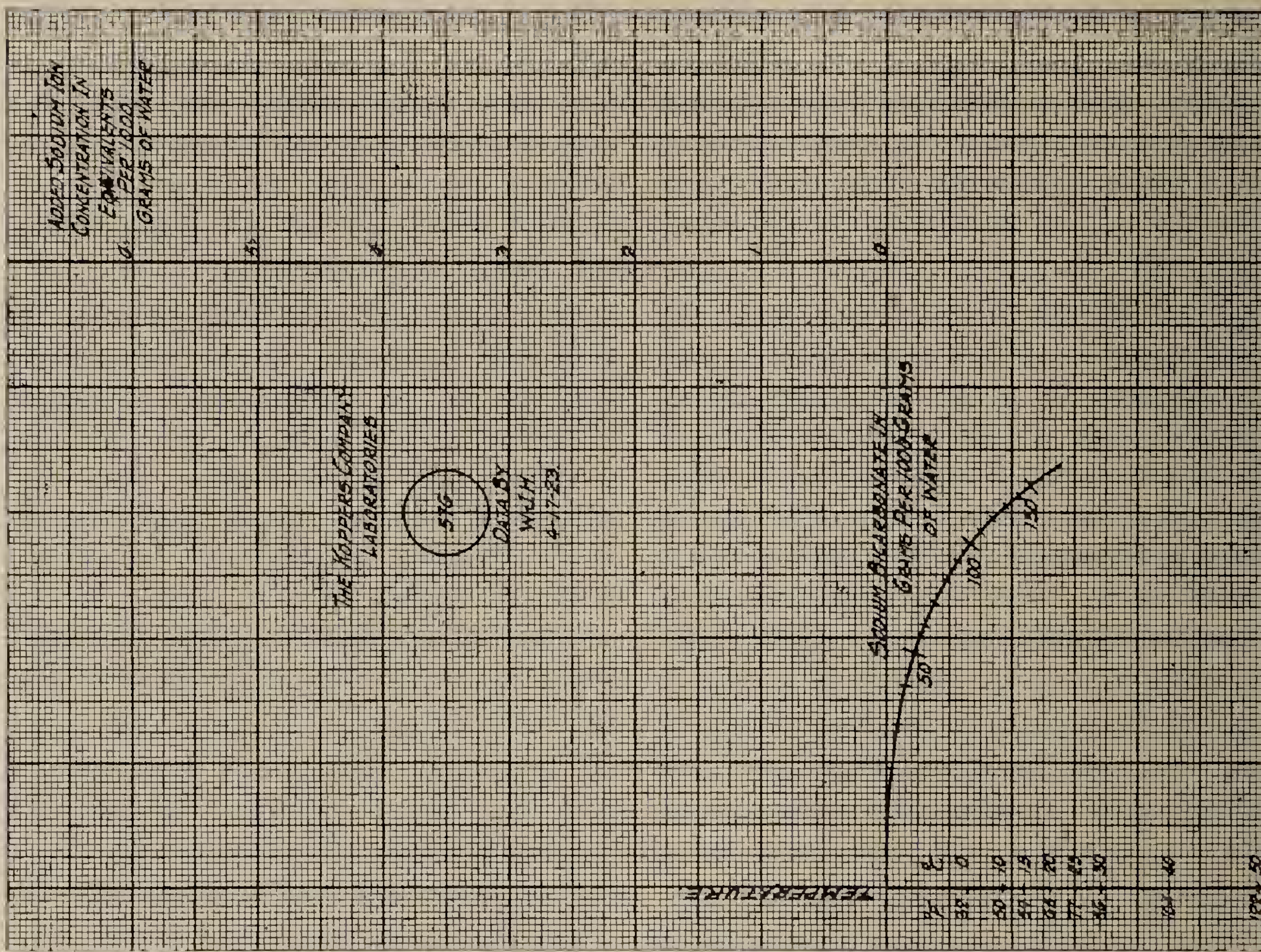

Fig. 6.—Alignment Chart—Solubility of Sodium Bicarbonate in the Presence of other Sodium Salts.

sulphate exclusively, the amount of sodium thiosulphate which may be present is 0.52x79 or about 41 grams of $Na_2S_2O_3$ per liter. 0.52 is multiplied by 79 because $Na_2S_2O_3$ weighs 158 grams per mol. and it contains two equivalents of sodium, therefore the weight of an equivalent is 79 grams. If the added salt were NaCNS exclusively, the permissible amount would be 0.52x81 grams per liter or approximately 42 grams; if it were sodium carbonate, it would be 0.52x53 or approximately 27.6 grams. If the added sodium ion were in the form of a mixture of these salts, any mixture is permissible whose equivalents when added total approximately 0.52 per liter or less.

Soda Consumption

The consumption of soda in the plants now operating varies from 0.019 to 0.09 pound per M cu. ft. and is usually equivalent to about 0.125 pound per pound of H_2S removed. At Battle Creek, however, the soda consumption is remarkably low—the average for seven months' operation being 0.019 pound per M cu. ft., or 0.028 pound per pound of H_2S removed. High soda consumption is due to high mechanical losses favored by excessive rates of circulation and excessive actifier air and to secondary reactions favored by high temperatures and large amounts of hydrocyanic acid. Secondary reactions are accelerated by certain substances such as iron oxide, which act as catalysts.

Power Requirements

The power required depends principally on the efficiencies of the pumps and fans installed, the height of the

towers, and the character of the packing. If a circulation of more than 50 to 60 gallons per M cu. ft. and air more than 2.5 times the gas volume are employed for the sake of obtaining a greater removal of hydrogen sulphide, the power cost will be increased out of proportion to the gain in efficiency. The Seaboard plant, on account of the arrangement of the apparatus, has higher pumping costs than usual and its total power requirement is 0.097 kw. per M cu. ft. of gas. The Battle Creek plant requires approximately 0.08 kw. per M cu. ft. Measurements made at the Rochester plant with a circulation of 55 gallons per M cu. ft. of gas and with the actifier fan operating to deliver 2.5 to 3 times the volume of gas indicated a consumption of 0.0525 kw. per M cu. ft. of gas. The Terre Haute plant uses 0.08 hp. or 0.060 kw. per M cu. ft. of gas.

If the catch boxes are arranged in pairs, as has been done at Seaboard, from 40 to 50 per cent of the power required by the liquid purification apparatus will be offset by the saving in the power consumption of the gas exhausters.

Cost of Operation

The cost of operation of the plant at Seaboard as published in the American Gas Association Monthly, April, 1922, p. 250, has been closely confirmed in the subsequent operation of the plant. The cost of liquid purification there is 0.34c per M cu. ft. and that of the catch box operation 0.13c, making a total of 0.47c per M cu. ft. The figures given by Mr. F. W. Seymour for the Battle Creek plant are 0.236c for liquid purification and 0.15c for catch box operation—a total of 0.386c per M cu. ft. Mr. W. S. Blauvelt in his paper read at the recent meeting of the Michigan Gas Association gives the following operating costs of the Terre Haute plant exclusive of royalty and capital charges.

Monthly Cost of Liquid Purification for 45,000,000 Cu. Ft. Gas.

	Total Cost	*Cost per M Cu. Ft.*
Supplies (principally soda)	$40.00	$0.0009
Labor*	45.00	0.0010
Power (0.01c per i.h.p.—hr.	36.00	0.0008
Total	$121.00	0.0027

Disposal of Actifier Air

One of the disadvantages of oxide purification is the disagreeable odor of the spent oxide which is a common source of neighborhood complaints. Liquid purification is not altogether free from a similar objection; but the cause can in this case be dealt with more effectively than in the case of oxide, which must be tolerated rather than abated.

The proper disposal of the air discharged from the actifier is always a most important consideration in the employment of the process in plants located near business or residential districts. Under ordinary atmospheric conditions, this air appears to be very rapidly diffused, and no odor will be noticed in the neighborhood of the plant, even if the air is being discharged undiluted. The topography of the country has some relation to proper diffusion, a flat country being more favorable than a hilly one. One plant located on flat land, not far from a residential dis-

*In a communication to the writer. Mr. Blauvelt has kindly made the following explanation of the "Labor" item:

"With regard to the cost of labor charged against the operation of our purification plant, you are entirely correct that this is merely a bookkeeping charge. No extra labor was employed, yet it is correct to charge against purification the actual time consumed in testing the strength of the circulating solution once a day, and in putting in the additional soda ash, and in making the tests to determine the quantity of hydrogen sulphide before and after purification."

trict has been in operation through extreme winter and extreme summer conditions, discharging the actifier air without dilution from a comparatively short stack, and not the slightest complaint has yet occurred. At certain other plants, however, in conditions of very still atmosphere and high humidity, diffusion has been so reduced as to make the direct discharge of the air objectionable. The odor noticed is not usually that of hydrogen sulphide; but is the "gassy" smell characteristic of direct contact cooling water.

One plant has employed artificial dilution for nearly a year and this will be used in a few of the new installations. If this method is depended upon, it is desirable to use a high stack, and under certain conditions in hot weather, diffusion may be so reduced that the odor may still be noticed unless some provision is made so that the diluted air will be a little warmer than the atmosphere. The power required to operate a diluting fan so that the discharged air will have not more than 20 grains H_2S per 100 cu. ft. is about the same as that required to operate the actifier fan, or about 50 per cent of the total power required in the ordinary plant without dilution.

The most effective method that has yet been devised for getting rid of the actifier air is to burn it, either under the boilers or in producers, retort settings or water gas generators. At Battle Creek for several months the air has been put under the boilers. No trace of hydrogen sulphide is left unconsumed. The amount of sulphur passing through the boiler tubes is not a serious item, being equivalent to the addition of about 0.5 per cent to the sulphur in the fuel.

At Boston, the air will be drawn through the actifier by the blowers operating in connection with the water gas machines, and so will be consumed in the latter. It is proposed to make similar arrangements at other plants operating gas producers. At Racine the air is being put into the retort settings.

In all such cases, it is desirable to remove any soda solution spray that may be carried by the actifier air. This may be accomplished by a simple baffle separator, by a small scrubber filled with coke or tile, or by other similar means. The removal of the soda is absolutely necessary where the air is to be put into retort settings or into the combustion system of coke ovens, as otherwise this material will cause a destructive fluxing of the brickwork.

Investigations have been in progress for some time, directed toward the development of methods of directly consuming the hydrogen sulphide in the actifier air. It is necessary to reduce to a minimum the amount of heating required, and good results have been obtained on a small scale in the use of contact material for accelerating the oxidation of the hydrogen sulphide. With certain contact material it is possible to obtain complete oxidation at a temperature of 200° C., which can be attained by burning a relatively small quantity of tar or oil. In practice, it is probable that still lower temperatures would be satisfactory, even with incomplete oxidation, on account of the great acceleration of diffusion that could be obtained.

Other work of our research laboratories has indicated the possibility of removing the hydrogen sulphide by means which will accomplish the recovery of a large part of the sulphur. We have also developed several processes in which liquid purification is accomplished without the use of actifier

air; but these invariably require more expensive and complicated apparatus and are only economically feasible in the treatment of gas high in hydrogen sulphide, and where sufficient credit can be obtained from the sulphur recovered to offset the increased investment and cost of operation.

Apparatus

The operation of the process requires a chamber filled with suitable packing material, in which the gas is brought into contact with the soda solution, a second chamber, similarly filled, in which the fouled soda solution from the first chamber is aerated, and means for continuously circulating and distributing the solution through the two chambers and for supplying air to the second chamber.

The first chamber, in which the gas is scrubbed with the soda solution, is known as the *absorber* and the second, in which the solution is aerated, is called the *actifier.* A considerable amount of experimental work has been done with a view to substituting mechanical washers for the static type of apparatus now used, and encouraging results have been obtained with the Feld washer used as an actifier, although this has not, so far, been satisfactory when used as an absorber. These results will be discussed later in this paper. The static apparatus in which the absorber and actifier are filled with packing, has so far commanded principal attention on account of its simplicity and comparative freedom from the risk of shutdown due to mechanical troubles.

Tower Packing

The most difficult problem in the design of our liquid purification apparatus has been the choice of a suitable packing for the absorber and actifier. All of our investigations have demonstrated the necessity of a large amount of contact surface per unit volume of gas treated. For the sake of economy, this contact surface must be concentrated in a small volume—otherwise the apparatus would assume unwieldy and expensive dimensions. At best, large volumes of packing must be employed, so that the price of the material used and the cost of installing it become very important. Moreover, the packing must be uniform in size to avoid irregular distribution, must offer a low resistance to the gas or air, and must not be subject to choking and flooding when the maximum rates of solution circulation are employed.

All of these requirements have been well realized from the start; but another has until recently escaped the attention that it deserves. This is due to the fact that in many plants the gas to be treated is by no means free from tarry matter which tends to accumulate on the packing and block the gas passages. Naphthalene, to a certain extent, behaves in the same way; but naphthalene can be removed if necessary by steaming, while tar cannot be so dealt with. The packing should, therefore, be of such a character as to reduce tar accumulations to a minimum—a requirement which is, perhaps, the most severe of all.

Spiral Tile manufactured by the Chemical Construction Company were used in the actifiers of the Seaboard plant, and in both the absorber and actifier at Battle Creek. They are now being installed to replace coke at Rochester. They have the advantages of strength, durability, low resistance and great free space and are excellently adapted to effect good distribution and

contact of gas and solution. They have the one disadvantage of high cost. Not only do they cost twice as much per cu. ft. as coke, but they offer much less surface per cu. ft. so that they require larger and more expensive apparatus, and the advantage of lower resistance is partially offset by higher pumping costs. A plant provided with spiral tile will cost 25 to 35 per cent more than one with coke packing. It remains to be seen whether they will be free from clogging in long continued service with dirty gas, but they have done well so far at Seaboard where there is much naphthalene trouble and at Battle Creek where there is much tar in the gas.

Wooden Hurdles were used in the absorbers at Seaboard, and in both the absorber and actifier at Terre Haute. They offer less free space and greater resistance than spiral tile, but are much better than coke in these respects. They are much less subject to channelling and irregular distribution than coke, but in this are probably not so good as spiral tile. At Seaboard they are in good condition after three years' service for benzol scrubbing and three more years for liquid purification so that their durability is satisfactory. They are probably less subject to clogging than any other packing that we have investigated.

Coke (½ inch to 1 inch size) was first investigated experimentally at Seaboard, then used partially at Battle Creek, Mich. and entirely at Rochester, N. Y. Racine, Wis. Oakland, Calif. Sacramento, Calif. Bethlehem, Pa. and Midland, Pa. and will be put into several other plants which are under construction. Experimentally, it gave better performance per unit volume than any other type of packing investigated. At Rochester, experience showed that for large scale use more coke was needed than had been indicated experimentally, and the later plants were designed larger with sufficient allowance so that other packing could be substituted if the coke should prove unsatisfactory. Even with this increase, however, coke is cheaper in first cost than any other packing. The Rochester plant, however, after about nine months' operation showed a gradual lowering of efficiency, and examination of the packing in the absorber showed that it was clogged with tar, coke breeze, shreds of bagging and other foreign material. Most of this material had evidently been carried into the packing by the solution. The coke in the actifier was clogged to some extent with tar. The trouble could have been prevented to a considerable extent by provision for removing the tar and other foreign matter from the solution; but it would evidently be difficult to prevent gradual clogging due to tar entering with the gas.

Coke has small free space and offers relatively high resistance, but this can be satisfactorily overcome by making the packing wide and comparatively shallow. The excellent results obtained at some of the plants indicate that this packing is satisfactory if it can be kept in good condition, and its low first cost makes a considerable saving especially in the larger plants. It is very important that it be sound and free from sponge and screened to a uniform size. Fine breeze should be rigidly excluded. Owing to the porosity of coke, it holds a considerable amount of solution and this may have a steadying effect covering irregularities of pumping. Tests recently made at the Crucible Steel Company's plant showed that the absorber would still remove 56 per cent of the hydrogen sulphide three minutes after circulation had been shut off. The gas

contained 450 grains H_2S per 100 cu. ft. and was being passed through the absorber at a rate of 435,000 cu. ft. per hour. After six and one-half minutes, the efficiency dropped to 22 per cent. The solution contained 2 per cent total alkalinity as Na_2CO_3. With higher strengths the removal of hydrogen sulphide could have been maintained over a longer period.

Crushed Quartz (½ inch to 1 inch size) has been tried in the experimental apparatus but has not yet been used on a large scale. In general it has the advantages and disadvantages of coke. It is stronger, but heavier and has practically no porosity.

A novel kind of packing will be tried in the plant of the Binghamton Gas Company which will use steel turnings.

Other forms of packing have been considered and it is planned to try certain of these experimentally. Most of the special forms of artificial packing would add very greatly to the cost of the apparatus, and unless it should prove possible to effect a reduction in the size of the apparatus without sacrificing efficiency, there would be no inducement to use any of them. The present status favors using spiral tile or wooden hurdles. If coke is used the system should be kept as free as possible from tarry matter, but since practically all of the trouble with stoppages appears to occur in the absorber, there may be an advantage in using coke in the actifier and spiral tile or hurdles in the absorber. This is being done at the Albany plant. There is considerable economy in using coke throughout in the larger plants, and in those equipped with double units the sections may be cleaned or refilled without great inconvenience and the expense may be small in comparison with the total saving effected.

Mechanical Washing

Interesting results have recently been obtained in the use of the Feld washer as an actifier. Experiments have been made at the Seaboard plant using a 7-section Feld washer, 2 feet in diameter. This apparatus was obtained through the courtesy of The Bartlett Hayward Co. and the tests were carried on in cooperation with representatives of that company. The results so far obtained, using the apparatus as an absorber, have not been encouraging, but very promising results were obtained when it was arranged for use as an actifier.

For this purpose, connections were made so that the Feld washer could be supplied with the fouled soda solution from the regular plant absorbers. Air was drawn through the washer by means of a steam jet and a speed of 550 to 580 r.p.m. was maintained in most of the tests. The more important data are shown in Table 3.

With the ordinary static type of apparatus, actification efficiencies of 75 to 80 per cent may be regarded as satisfactory, it being possible to obtain an absorption efficiency of 90 per cent or more under these conditions. The static actifier of the usual design requires about 40 to 50 cu. ft. of air per gallon of solution in order to obtain such an efficiency. The results obtained with the Feld washer indicate that, with this apparatus, satisfactory actification may be expected with three-quarters to one-half of the air required by the static actifier. Thus, the Feld washer may be especially useful in situations where the disposal of actifier air is a troublesome problem and where the quantity of the air to be handled should be re-

duced to a minimum. With this type of apparatus difficulties of irregular distribution, stoppages, and channelling, inherent in the static actifier, need not be feared, but it possesses the disadvantage of any mechanically operated washer in that it cannot be expected to operate without occasional shutdowns and some provision must be made to take care of the purification of the gas at such times.

Arrangement of Absorber and Actifier

The single tower apparatus in which the absorber and actifier are built together in the same shell has proven to have decided advantages over the system installed at Seaboard, in which the absorbers and actifiers are separate. The former arrangement requires only one pump and one circulating sump and eliminates the necessity of watching the sump levels and keeping two circulation systems in balance. The apparatus is more economical, requires less ground space and less volume of solution and is almost automatic in its performance. In all the present plants, the absorber is placed above the actifier, the immediate actification of the solution reducing the tendency to secondary reactions. The sump is thus always filled with freshly actified solution. In many cases it would not be feasible to place the actifier above the absorber, because the gas pressure is so high as to make gravity distribution impossible without adding greatly to the height of the tower.

Figure 7 shows the general arrangement of typical plants now being installed. In the first single tower plants that were designed, a single diaphragm separated the absorber and actifier, and a working platform was built around the upper part of the actifier section so that the sprays and spray piping could be inspected. In later installations, the arrangement, first used by the Indiana Coke and Gas Company, was adopted. In this a working space is provided between the absorber and actifier and the sprays are directly accessible and can be cleaned without removing them.

Figure 8 shows several arrangements of apparatus that may be installed to provide for various conditions. Arrangement A is the ordinary single tower. This should continue in oper-

TABLE 3

EXPERIMENTS WITH FELD WASHER USED AS ACTIFIER

All Results Obtained with 7 Section Except those Marked *

Solution Rate Gal. Per Hr.	Air Rate Cu. Ft. Per Hr.	Cu. Ft. Air Per Gal. Solution	Inlet H_2S Grains Per Gallon	Outlet H_2S Grains Per Gallon	Efficiency %
300	6000	20	43.5	11.2	74.3
300	6000	20	44.5	13.6	69.4
360	7200	20	47.0	11.4	75.7
360	9000	25	38.6	7.4	80.8
360	9000	25	52.0	12.8	75.4
360	9000	25	72.5	15.5	78.6
240	7200	30	72.0	10.4	85.6
300	9000	30	66.5	10.0	84.9
*300	9000	30	75.7	15.4	79.7
*300	9000	30	41.5	9.9	76.1
300	9000	30	39.6	9.4	76.2
225	9000	40	52.5	6.9	86.8
225	9000	40	44.0	5.8	86.8

*5 Sections

ation for a long time without the necessity of steaming or cleaning, unless the gas carries large amounts of tar or naphthalene. The actifier may be shut down for several hours and still a considerable amount of purification will be accomplished in the absorber, especially if the solution is strengthened by the addition of fresh soda.

Double Unit Systems

In the arrangement B, the absorber and actifier are each divided by a vertical diaphragm so as to constitute two

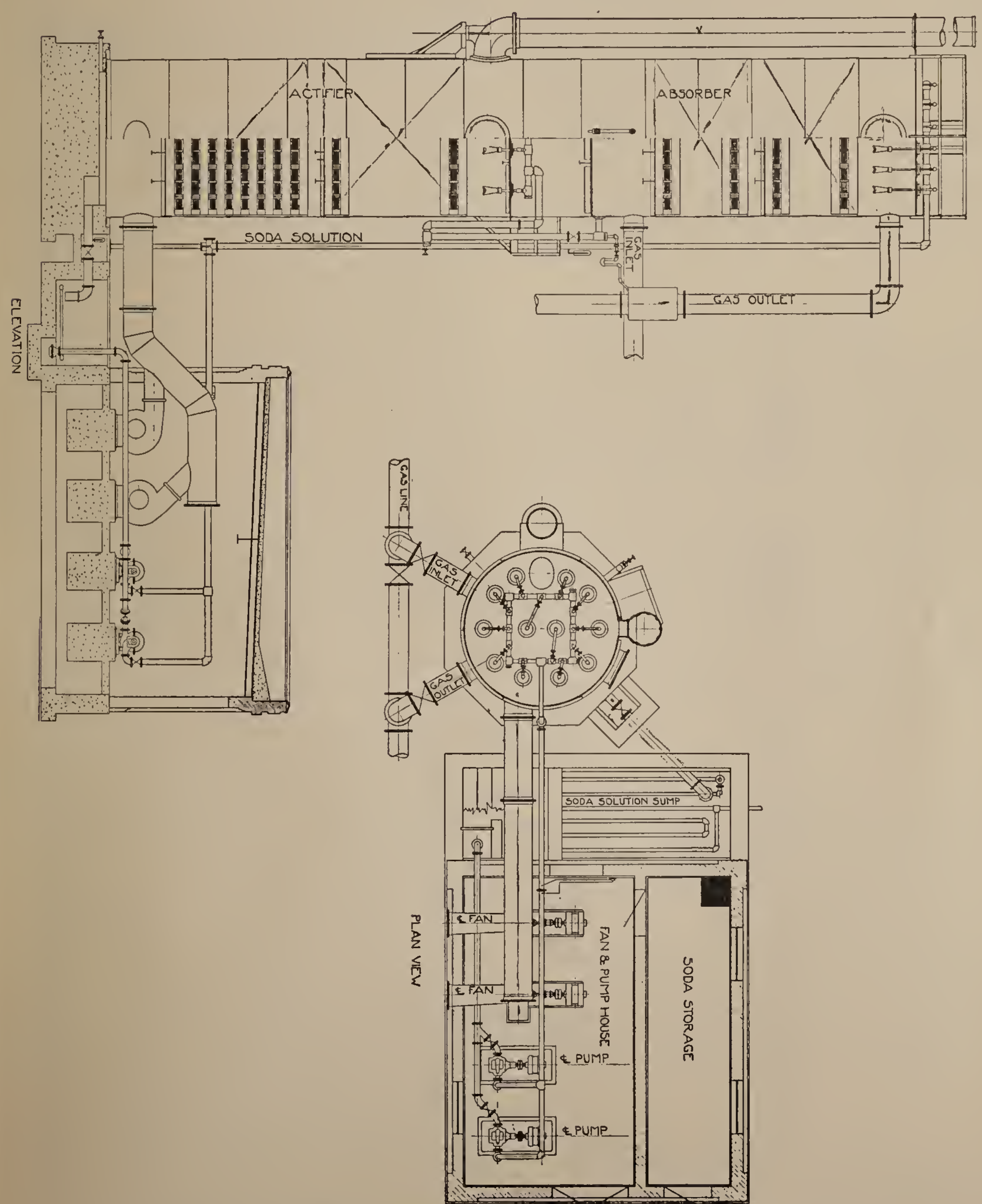

Fig. 7.—General Arrangement, Koppers Liquid Purification Plant. Single Tower System.

absorbers and two actifiers in a single tower. In this system either absorber or either actifier may be shut down for steaming, cleaning, or repairs, while the rest of the system continues in operation. Even at full capacity 70 to 75 per cent of the hydrogen sulphide will be removed during such a partial shutdown.

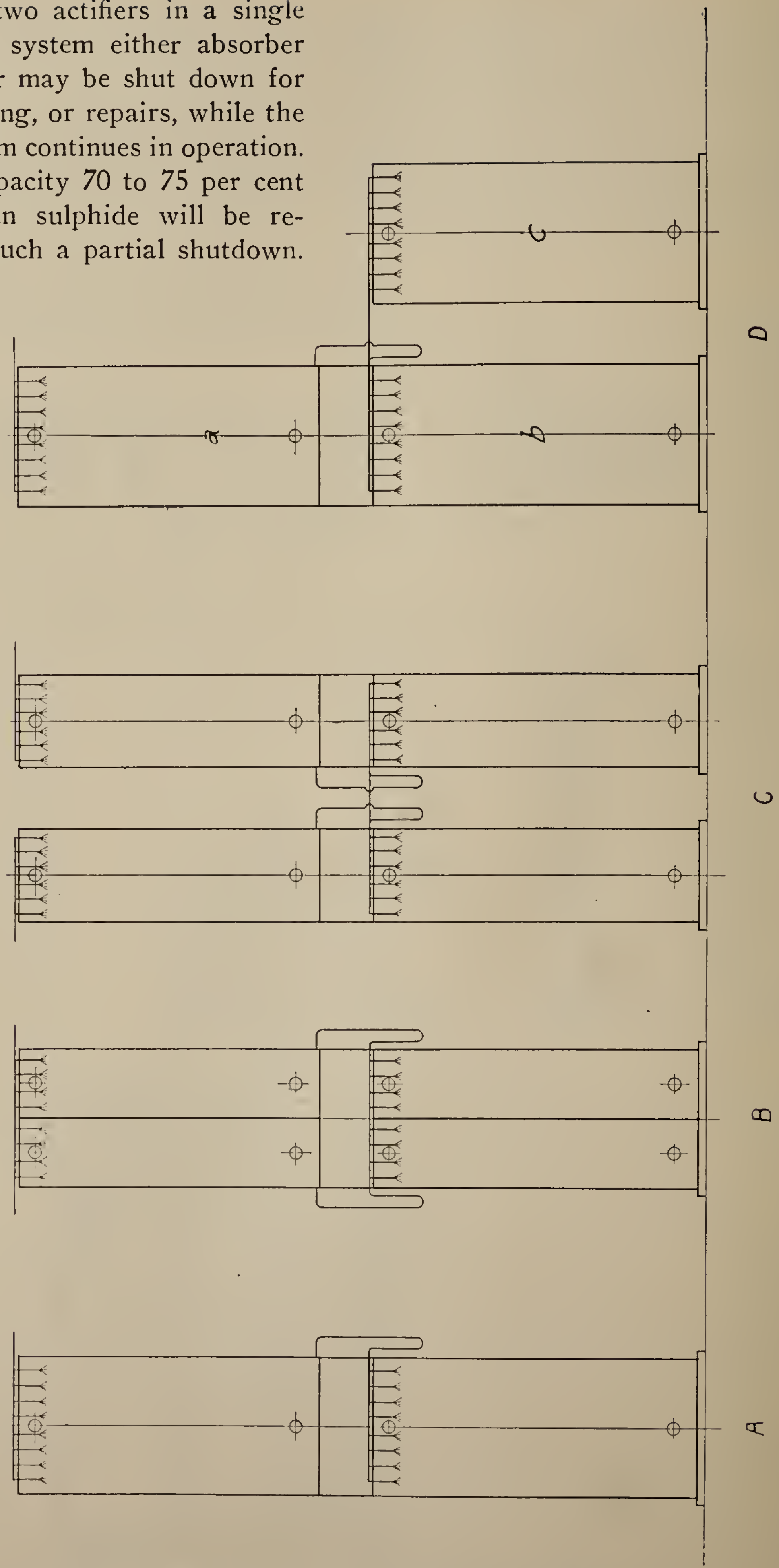

Fig. 8.—Various Arrangements of Absorber and Actifier.

This, which we call the Double Unit System, has the further advantage that only half of the apparatus need be used during periods of low gas production, or during such periods, if a high degree of purification is required, the two absorbers may be connected in series, and with the actifiers operating in connection with separate sumps, almost complete purification may be obtained.

For larger sized plants, it is preferable to construct the Double Unit System in two towers as shown in C. This is being done for the Louisville Gas and Electric Co., Louisville, Kentucky. Here each of the two towers may be operated singly or they may be operated in series or in parallel. Each tower has capacity to provide 6,000,000 cu. ft. of gas per 24 hours.

System with Spare Actifier

In case of a plant handling a steady load, where it is desired to provide for shutting down either the absorber or the actifier while maintaining a high degree of purification, the arrangement shown in D may be preferable. In this arrangement, section *b* is connected so that it can be operated either as an actifier in combination with absorber *a*, or as an absorber in combination with actifier *c*. In this system, either *a*, *b*, or *c* may be shut down without interfering with the full performance of the plant. It has been proposed in certain cases to install a Feld washer in the place of actifier *c* and to operate this regularly in connection with absorber *a*, thus obtaining the advantages of gravity flow in combination with the low air requirement of the Feld washer. Section *b* would only be used as an actifier when it would be necessary to shut down the Feld washer.

Comparison of Costs

Taking the unit cost of a 5,000,000 cu. ft. liquid purification plant with single tower filled with wooden hurdles as 100, the cost of each of the other systems of the same capacity will be in the following proportion:

System A—Single Tower	100.0
System B—Double Unit—Single Tower	105.3
System C—Double Unit—Two Towers	109.4
System D—Single Tower with spare Actifier	136.1
System D—Single Tower with Feld Washer as spare Actifier	162.7

The cost of valves and piping for series operation of the double unit system is not included.

Separate Absorber and Actifier

Sometimes there are advantages in installing a separate absorber and actifier. This is especially true where the boilers or other points of consumption for the actifier air are at some distance from the place where it is necessary to locate the absorber. It is cheaper to carry the soda solution back and forth than to pipe the actifier air over a long distance. At the Minneapolis plant advantage is being taken of a hillside location to provide gravity flow from the absorber to the actifier.

The towers are usually of circular cross section, but other forms are being used in special cases to economize ground space or to utilize existing apparatus. The tower at Denver is elliptical and that at Minneapolis is rectangular. Utilization of existing benzol scrubbers or other apparatus has played quite an important part in the application of the process.

Treatment of Gas under Pressure

An important advantage of the process in comparison with oxide purification is that it permits of the removal of hydro-

gen sulphide and hydrocyanic acid under high pressure. This is both difficult and dangerous to accomplish in oxide boxes even under moderate pressures, on account of the difficulty in making such boxes sufficiently strong and tight and on account of the increased concentration of the impurities in the gas. On the other hand, liquid purification apparatus can readily be designed to operate even under the high pressure encountered in the natural gas fields, and the higher the pressure the more efficient is the performance of the process. The plant which is being installed for the Consolidated Gas, Electric Light and Power Company near Baltimore, Maryland is designed to treat coke oven gas under 25 pounds pressure and will have capacity for 24,000,000 cu. ft. per 24 hours. Special arrangements have to be made in sealing the line conveying the solution from the absorber to the actifier sprays, but otherwise the design of this plant differs little from those operating at lower pressures.

Purification of Natural Gas

In this connection the work that we have done in the purification of natural gas under high pressures may be briefly referred to. A special paper is being prepared on this subject and will soon be published. The work was done through arrangements made with The Union Natural Gas Company and tests were conducted on the gas in their Tilbury Field at Port Alma, Ontario. An experimental apparatus was used treating from 1500 to as high as 3000 cu. ft. of gas per hour. The gas pressures ranged from 60 to 120 pounds per sq. in. and the gas contained approximately 350 grains of H_2S per 100 cu. ft. under standard conditions, or 2800 grains per 100 cu. ft. at 120 pounds pressure.

The gas contained no carbon dioxide, so arrangements were made to supply the small amount which it was considered might be needed by adding a carbonating section to the actifier. The exhaust from a gas engine was cooled and passed into this carbonating section. The results, however, indicated that it might be possible to dispense with this arrangement. Some of the results showing the relation of solution rate to the hydrogen sulphide content of the outlet gas under different pressures are shown in Figure 9. The relation of the hydrogen sulphide content of the outlet gas to the pressure is shown in Figure 10. The results demonstrated conclusively that the hydrogen sulphide content of such natural gas can readily be reduced to 30 grains per 100 cu. ft. (standard conditions) or less. With additional apparatus, practically complete purification could be attained.

Complete Purification

In the writer's previous paper, it was indicated that complete purification can be obtained with the process without the necessity of using oxide. The method indicated was, however, expensive for ordinary conditions, requiring two absorbers in series, each connected with a separate actifier and needing considerable power for the additional pumping and actification. Subsequent work has developed more effective and economical methods.

It has been shown that complete purification is difficult to accomplish in a single stage system without very greatly decreasing its capacity. In the ordinary single stage system, a little hydrogen sulphide remains in the form of sodium hydrosulphide in the actified solution. In order to remove the last traces of hydrogen sulphide from the gas, the last traces of hydrogen sulphide must be removed from the solution. On the other hand,

since only a few grains of hydrogen sulphide remain in the gas passing out of the absorber, only a small volume of solution is required to furnish the alkali necessary to remove all of the hydrogen sulphide. The essential conditions are that the solution thus employed for the removal of the last traces from the gas be free from sulphide compounds such as exert a partial pressure with respect to hydrogen sulphide, and that the solution in the second stage be distributed over a very large surface to ensure thorough contact with the gas.

Therefore, we must have as essential apparatus for complete purification a secondary actifier in which the last traces of hydrosulphides are removed and a secondary final absorber in which the solution from the secondary actifier is thoroughly distributed over a very large surface and brought into intimate contact with the gas.

In order to provide the secondary actifier, one of the smaller benzol scrubbers at Seaboard was equipped so that part of the solution from the actifiers could be pumped from it and thoroughly aerated. As a secondary absorber, one of the purifying boxes was filled to a depth of 6 ft. with coarse shavings and equipped with sprays to distribute the solution from the secondary actifier over the shavings. It was estimated that approximately 5 gallons of solution would be required per 1000 cu. ft. of gas, and the problem was to obtain effective distribution and contact of such a small quantity. The amount of soda actually required was so small that the amount adhering to the shavings would be sufficient to purify the gas for a long time, and so the idea was con-

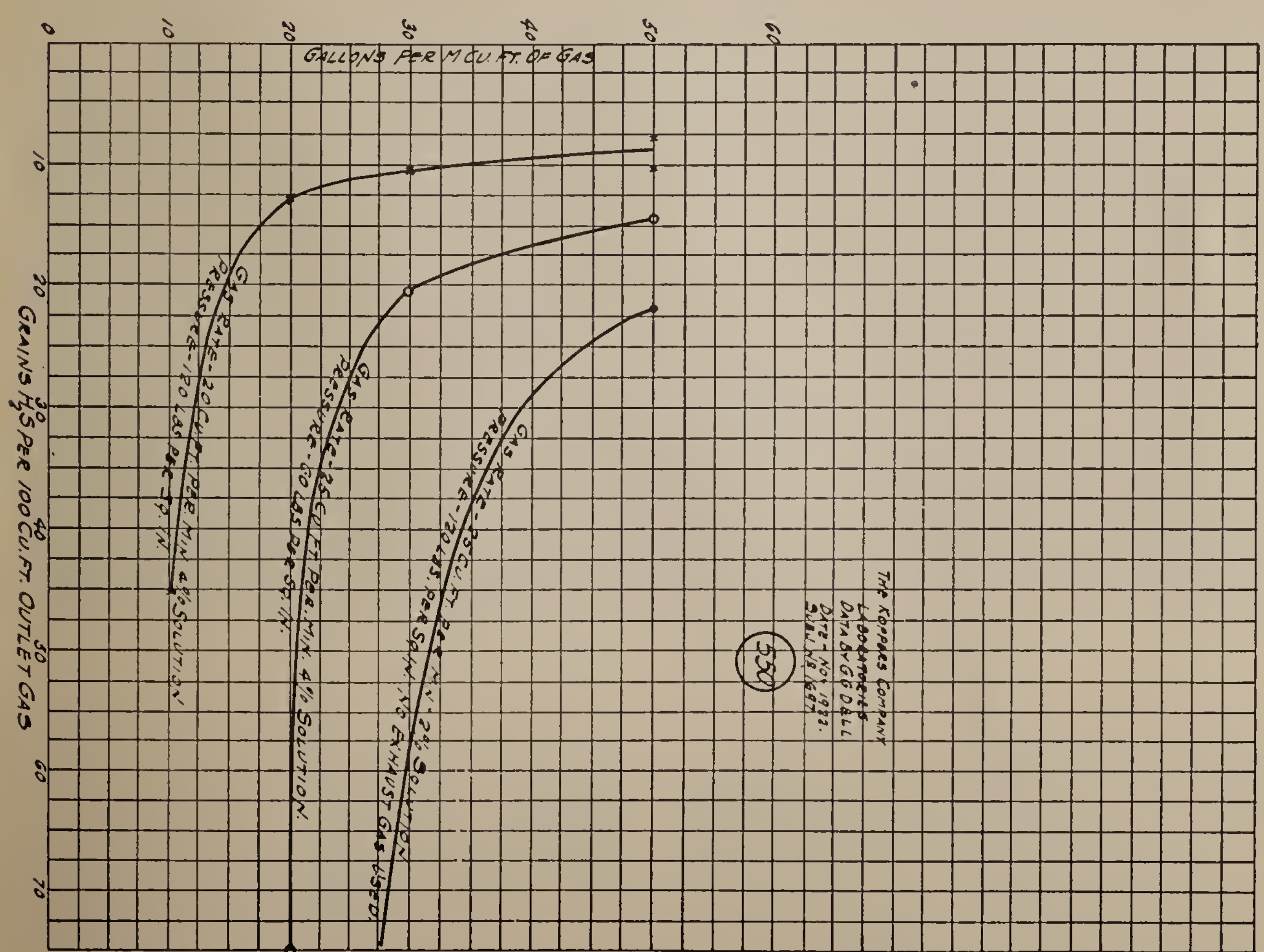

Fig. 9.—Purification of Natural Gas. Relation of Solution Rate to H_2S Content of Outlet Gas.

ceived of securing the necessary distribution by pumping the solution intermittently and at a high rate. This was provided for by arranging a tank to collect the solution from the secondary actifier. Electrical contacts on a float operated a signal bell when the tank was full and a motor driven pump was started emptying the tank in about ten minutes. In this way the shavings were drenched with the highly actified soda solution every two or three hours and this interval was found sufficient to secure very satisfactory results. Most of the apparatus used at Seaboard is shown in Figure 11, the small benzol scrubber on the extreme right being the one used for secondary actification. The two primary actifiers and the small building housing the pumps and fans are also shown.

This system was in operation at Seaboard from June to November, 1922, during the high sulphur period previously referred to and was found very useful in relieving the load on the catch boxes. It was demonstrated that gas containing 15 grains of H_2S per 100 cu. ft. could be reduced to about 0.75 grain per 100 cu. ft. at a rate of 6,000,000 to 8,000,000 cu. ft. per 24 hours and that this efficiency could be maintained for seven hours without adding fresh solution. The hydrogen sulphide in the outlet gas increased with that in the inlet and it was not possible to obtain complete purification with a single box even at low gas rates. However, tests made with an experimental 6 ft. column of pea coke, placed in series with the box and intermittently sprayed with the soda solution, showed that complete purification could be obtained with two boxes in series with the gas entering the first box at 50 to 60 grains H_2S per 100 cu. ft. and that even a higher degree of

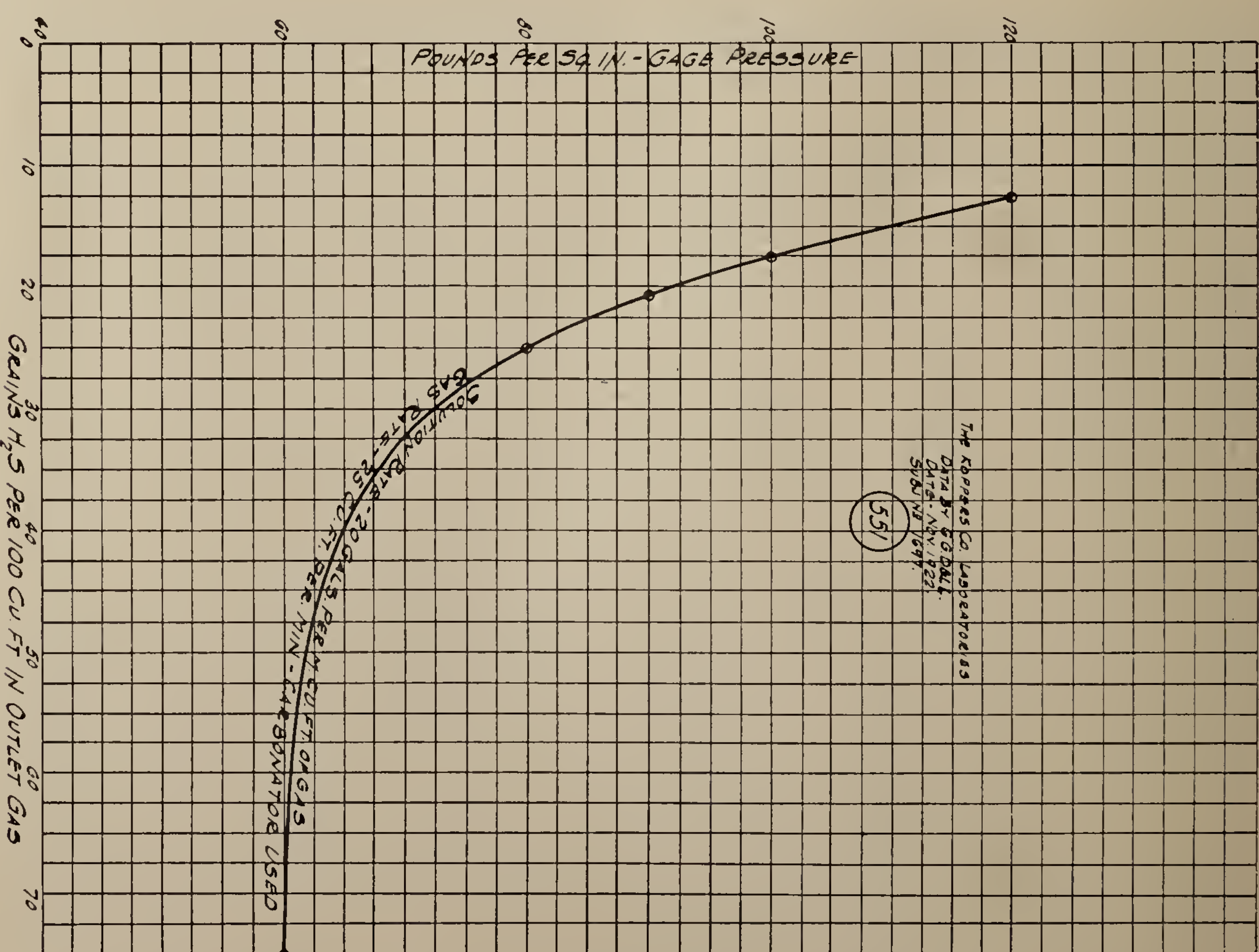

Fig. 10—Purification of Natural Gas. Relation of H_2S Content of Outlet Gas to Pressure.

purification could be obtained than with oxide. The pressure drop through two such boxes is less than if they were filled with oxide.

With this system, a considerable amount of air was required for the secondary actifier. It was found that this could be greatly reduced by heating the solution to 50° C. or higher. A similar reduction could undoubtedly be attained

The secondary system at Seaboard was discontinued in November, 1922, as the sulphur conditions were then becoming normal and the benzol scrubber was needed for other purposes. Sufficient data were, however, obtained so that a plant for complete purification with soda only can be designed if the need arises. The shavings were found rather badly compacted and matted and pea coke is considered preferable as a filling material.

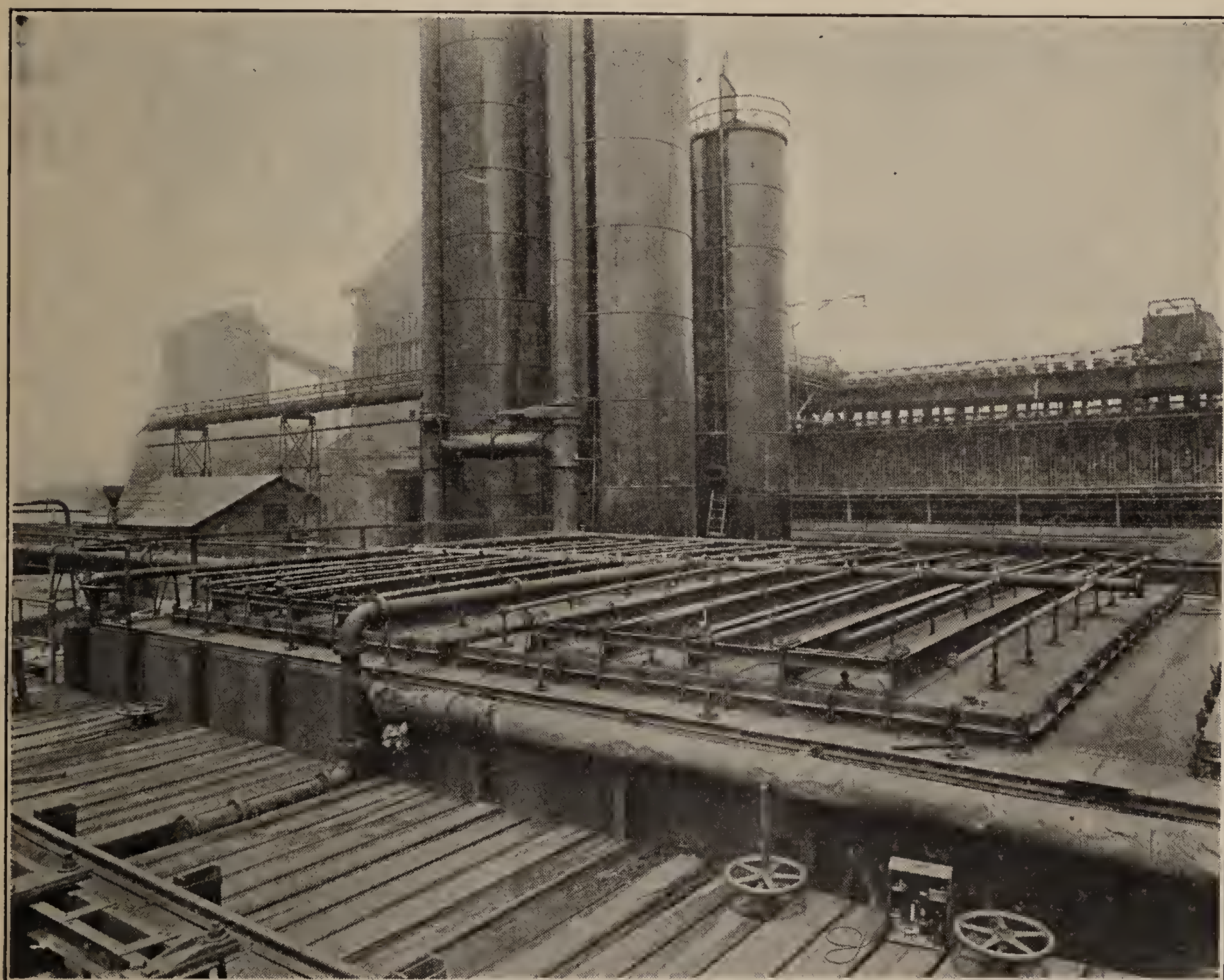

Fig. 11.—Apparatus for Complete Purification at Seaboard Plant.

in the primary system, but here too great a warming of the solution is objectionable on account of increased soda consumption due to secondary reactions. In the secondary system, the amount of solution is so small that this makes practically no difference.

Figure 12 shows an arrangement of apparatus for a complete purification plant according to the methods that have thus been developed. The operation of the primary apparatus A is conducted as usual, removing approximately 90% of the hydrogen sulphide from the gas which

then passes into the final absorbers B and B′ arranged in series. These absorbers are ordinary purifier boxes filled with pea coke and equipped with sprays.

A portion of the solution from the primary actifier is continually withdrawn through the pipe C into the heater D where it is brought to a temperature of

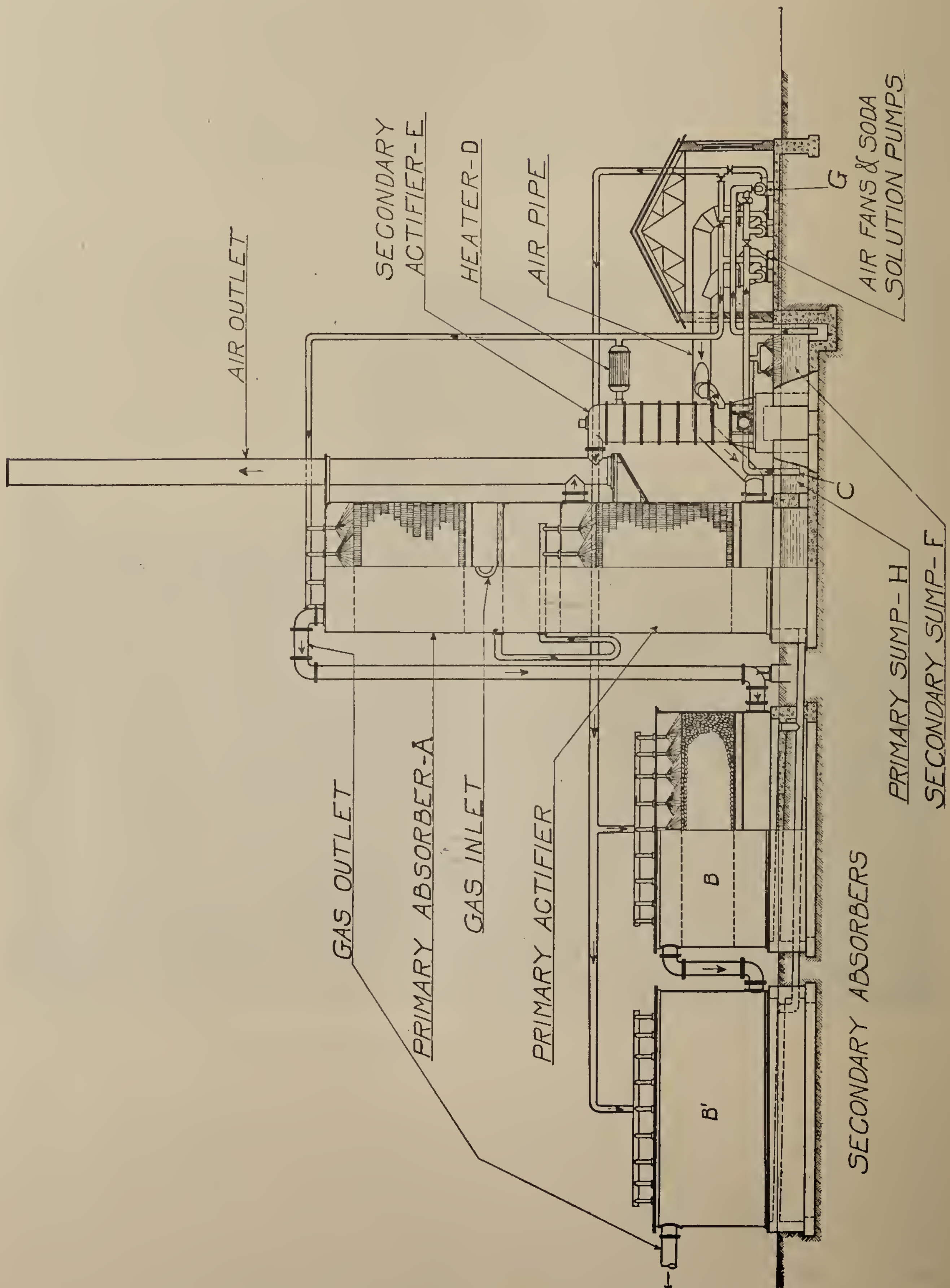

Fig. 12.—General Arrangement of Complete Liquid Purification Plant.

50° C. or higher. The heated solution then passes into the secondary actifier E which is here shown as a Feld washer. Here the last traces of hydrogen sulphide are removed and the solution passes through cooling sprays into the secondary sump F. Automatic arrangements are provided to start the pump G at regular intervals, say every two or three hours, and pump the solution over the final absorbers. Any make-up soda required in the primary system should be added to the secondary sump and will increase the activity and capacity of the secondary solution. The solution from the final absorbers is drained back to the primary sump H and thus returns to the primary system. Approximately 8 gallons of solution are required per M cu. ft. of gas in the final absorbers.

The principal item of expense in the final purification thus conducted is the steam required for heating the solution, about 10 pounds of exhaust steam being used per M cu. ft. of gas. In certain cases it may be feasible to employ waste heat instead of steam. An estimate prepared for the Seaboard plant has indicated that if no charge is made for the exhaust steam used for heating the solution, the operating cost of final actification will be 0.042 cents per M cu. ft. Where steam is expensive and no other means of heating can be provided, the process offers little in the way of economy in comparison with the use of oxide catch boxes.

In most cases a system of liquid purification in combination with oxide catch boxes has advantages of its own. The catch boxes have useful reserve capacity, require practically no attention, and last for many months without the necessity of renewal. In certain cases, however, complete liquid purification may be entirely feasible and advantageous. Some plants may find advantage in using one or two boxes equipped with sprays in conjunction with oxide boxes as we have done at Seaboard.

Some idea of the extent of the field opened in the development of the Seaboard Process with its modifications and related processes, may be gained from the fact that this has involved the filing of over thirty United States patent applications, all of which have been favorably acted upon, and several of which have been granted. The work is an excellent example of what can be achieved by organized research, and for the results achieved since the first paper was written, especial credit should be given to Mr. C. J. Ramsburg, Vice President; to Messrs. D. L. Jacobson, W. J. Huff, and L. Logan of the Research Staff, and to Messrs. E. H. Bird and C. W. Garrison of the Contract and Operating Departments of The Koppers Company.

List of Articles on the Koppers Company Process of Liquid Purification

The Seaboard Process of Liquid Purification. General description of the process and its development, by F. W. Sperr, Jr., Technical Section, American Gas Association, Vol. 3 (1921) p. 282, and American Gas Association Monthly, Vol. 4 (1922) p. 243; see also Gas World, Vol. 76 (1922) p. 334.

Plant for Liquid Purification of Gas. Description of Seaboard Plant and results, Gas Age-Record, Vol. 48 (1921) p. 510.

Liquid Purification at Battle Creek. Description of Battle Creek Plant and results, by Fred W. Seymour, Gas Age-Record, Vol. 50 (1922) p. 765; also published in the Gas Journal, Vol. 160 (1922) p. 566.

Report on Liquid Purification. Comparison of the Seaboard and O'Neill

Systems of Gas Purification by A. M. Beebe, Gas Age-Record, Vol. 49 (1922) p. 741; see also Gas Age-Record, Vol. 50 (1922) p. 106.

Seaboard Liquid Purification Process. Description of Racine Plant and results by H. R. Broker, Gas Age-Record, Vol. 51 (1923) p. 499. See comment by F. W. Sperr, Jr., Gas Age-Record, Vol. 51 (1923) p. 639.

Description of Allentown-Bethlehem Plant, Gas Age-Record, Vol. 51 (1923) p. 766.

Some of the Latest Developments in Gas Purification, by E. H. Bird, Chem. and Met. Eng., Vol. 29 (1923) p. 16.

The progress made in liquid purification has been reviewed by C. J. Ramsburg in a paper read before the American Society of Gas Lighting in April, 1923. This paper has been published under the title of "Liquid Purification Results" in the Gas Journal, Vol. 63 (1923) p. 419.

A paper recently read by W. S. Blauvelt at September, 1923, meeting of the Michigan Gas Association gives an interesting description of the gas purification system at the plant of the Indiana Coke and Gas Co., Terre Haute, Indiana.

DISCUSSION

C. H. Stone (Rochester, N. Y.): I understand that the reference to little or no data on the corrosive effects of cyanogen refers to the action of pure cyanogen alone on different metals. There is considerable in the literature on the effect of cyanogen in gas on the iron of pipes and on meters, although at present there is a great controversy on in the English Journals as to whether cyanogen or carbon dioxide plus oxygen is the prime mover. There is much evidence, however, which points to cyanogen as an active agent. Defoy in the English Journal in 1908 speaks of the corrosion of holders as due to cyanogen. The American Gas Institute Proceedings for 1910 assert definitely the corrosive action of cyanogen in gas on iron and steel. The report of the Life of Gas Meters Joint Committee in 1922 specifically mentions the corrosive action of hydrocyanic acid and its salts. Dr. Bertelsmann says that neither the oxygen or the hydrocyanic acid attack the iron on their own account to an appreciable extent, but the great danger rests with the combination of the two. In the German Journal for Oct. 28, 1922, in a long article by one of the most eminent German authorities, occur these two sentences: "If the deadly action of hydrocyanic acid in gas were not much underrated, more would be done for its removal" and "In my opinion cyanogen, carbon dioxide and oxygen act jointly and assisting each other, on metal parts." Mr. Sperr, in his paper before this convention, speaks of the importance of hydrocyanic acid as a cause of meter corrosion and says that there can be no doubt that there is a considerable saving in distribution costs due to its removal. Now if we are to accept this evidence, should we not take one step more? I have heard eminent men state their belief that most of the holder collapses that have occurred of late are due to cyanogen. I think this is a question of such importance that we should spend some time and money in getting the best evidence possible on the subject.

What we need is a chemical study, first of the action of cyanogen and then of cyanogen plus oxygen plus carbon dioxide on different kinds of metal. This should be undertaken by some college or government bureau.

If it is accepted that hydrocyanic acid is an important corrosive agent, then we need some method for its removal and some study of the conditions surrounding its formation. True, the Seaboard process will take out 90%, but the vast majority of companies do not have it and will not for years to come, and this majority needs protection. It may be that we are over-anxious on this subject, or it may be that we do not realize its full importance.

Regarding the organic sulphur I am inclined, from a rather considerable experience in this subject, to question the removal of 50% in passing through the boxes, as shown in one test each at plants B and D. I feel that we have proved that there is very slight removal of it, and that there may be an actual increase. We established the latter very conclusively by a number of tests not shown in this report. We also have at least fair evidence that the Seaboard process removes little or none, and neither in our case does the light oil scrubber. The lesson from it all seems to be that if we are going to use higher sulphur coals (and we are) we need to devise a method for lessening carbon disulphide. It is true that none of our tests approached the legal limit. Consider, however, that only four companies reported; that aside from plant A, no company reported over 5 tests and then read the reports of the Massachusetts State Inspectors—9 violations of this sulphur limit in one year, and remember that this condition will be vastly worse as time goes on. This looks to me as if we cannot afford to sit quite as pretty as we think.

As to the processes for lessening carbon bisulphide, a word or two will indicate why I do not think we have yet reached the solution of this question. The old Hall process costs 1c and the Carpenter-Evans process 1½c per M.; the Rideal-Taylor may cost 1c per M. Compared with present costs of purification, this seems to me to be too much. The Halifax process has no figures given for cost, but I doubt if they would be small. As to Mr. Hall's new process, I fear that I cannot agree with his conclusions. You cannot make one piece of apparatus remove three or four things, and remove each efficiently, when the conditions necessary for satisfactory removal of each are entirely different. The temperature best adapted for sulphur removal, given by Mr. Hamilton as 50-60° F., would be impossible to maintain (in our case) for a large part of the year. Moreover, this is far from the best temperature for naphthalene washing, which some consider to be about 114° F. The temperature for benzol washing is between the above two, although of course much nearer the sulphur than the naphthalene. We find that it is impossible to get maximum efficiency in even benzol and naphthalene removal in the same scrubber. It might be done with two or more towers, one devoted to naphthalene at one temperature and one to benzol at another temperature. This would mean two stills and two pumping systems, which will add materially to the overhead. It is also a question whether it pays to recover benzol for motor fuel; certainly not when gasoline sells for 17c per gallon. If Mr. Hamilton, after long experience, can only remove 50% of the carbon disulphide, I fail to see how Mr. Hall is going to find it easy to remove 75%. Again, I doubt if the scrubbing is going to remove the cause of gummy deposits. Dr. Brown, who has been studying this subject for two years, says these have, so far as his present research goes, come only in the case of water gas;

we are never likely to scrub water gas for the sake of removing an excessive amount of organic sulphur. I may be an optimist, but I believe there is a better process for us somewhere ahead.

F. J. Ikena (Baltimore, Md.): I would like to ask Dr. Powell if he has any report on organic sulphur. And also, did I understand Mr. Sperr to say that Denver is the only plant in which they have the liquid purification of the water gas?

J. A. Perry (Philadelphia, Pa.): In Mr. Sperr's paper we find a great deal of very valuable information and I think it will be helpful to the Koppers Company in developing their process. The data they give should help us to form better ideas of the process and how we can help them when we have the plant in operation.

We have been very much pleased with the operation of the Allentown plant in the removal of both hydrogen sulphide and cyanogen. Our September report shows about 97 per cent of the hydrogen sulphide removed, operating on an average day of 3,000 M. per day. One of our tests shows that with 52 grains of cyanogen per hundred feet of gas the process has removed all but 1.7 grains, or about 97 per cent. At the high rates of purification, we would not get the 97 per cent; as given in this paper it will come down to 75 or 80 per cent more likely, but even at that we are pleased with that part of it.

It will be noted that we use about .075 pound of soda per thousand feet of gas instead of .05, which is about 50 per cent more than Seaboard. We account for this principally in reducing about 10,000 feet of air per thousand feet of gas purified in the actification process. We do this because we wish to dilute the air as much as possible, and we only have the fan blowing through the apparatus to do that with. This means that the air is going out with about 50 grains of hydrogen sulphide with 100 feet of air. And we have had complaints about this.

Mr. Sperr says that this is due to some organic sulphur compound, and he also states that the process does not remove the organic sulphur. How can it then get into the liquid and the air? I am very much inclined to believe the H_2S is the cause of the complaint. Besides putting H_2S into the air our test showed that with extreme actification we are putting cyanogen into the air also. I do not know what that means in the way of complaints.

If the Koppers Company has some process which they feel they can put in somewhere without polluting the air with this poisonous gas, I would like to try it out on some plant in the U. G. I. system. I do not believe that we will be allowed to pollute the atmosphere at any place, and we have two or three plants where we cannot burn it under the boilers or in the producers.

L. J. Willien (Boston, Mass.): I was rather surprised in the committee's report at the statement about iron oxide taking out carbon bisulphide from the gas, especially when it was new. It has been my experience that if it does take out any material it is usually the spent material that does the removing. Several years ago we had considerable sulphur trouble in some of our plants and we tried using spent oxide for taking out the sulphur compounds. It did take out a little, but as Mr. Stone said, it was not reliable. I went on the theory that since carbon bi-sulphide in liquid form is a solvent for free sulphur, if you reverse the conditions, why would not free

sulphur remove carbon bisulphide when passed through in vapor form? I made some tests on a small scale by passing gas through free sulphur, and I did get a reduction of about 25 per cent. But that is unreliable. If you get an increase in temperature, or the sulphur becomes saturated with carbon bisulphide, you will get a reverse action in which the sulphur will give off carbon bisulphide.

If we could get some process for removing the organic sulphur, as simple as the liquid purification process for removing hydrogen sulphide, it would be a great step, because we are coming to a time when carbon bisulphide is going to increase in our gas. We have had it as high as 120 grains per hundred cubic feet going into the purifiers. We used lime at the time. While we removed between 50-60 per cent of the carbon bisulphide with lime it is very uncertain. As the lime becomes fouled it absorbs both carbon dioxide and hydrogen sulphide, and at the same time removes carbon bisulphide. In time a point is reached when the carbon dioxide attacks the sulphur compounds of lime, setting free both hydrogden sulphide and carbon bisulphide which will be carried forward with the gas.

I believe that the most promising method is the heat treatments which have been touched on.

W. J. Huff: I think that corrosion is one of the most important points, and there have been a great many important points contained in Dr. Brown's paper.

It was my good fortune for a period of about a year and a half to work under Mr. Fieldner, with the government, on problems of corrosion, and I had an opportunity to realize the very, very important role played by oxygen in corrosion. The practical effect of this must be enormous. Every gas company has a great share of its investment in the distributing system, and this is largely in the form of iron and steel. Any means that can be taken to reduce the oxygen content of the gas which is being distributed should be encouraged and studied. I think we want to go away remembering that.

As to the role of cyanides, I am familiar with at least some of the references quoted by Mr. Stone. I am familiar with the arguments that have been going on about the relative role played by oxygen and carbon dioxide and cyanide in causing corrosion, but some of these arguments, have hardly been scientific. That is, they have been based in many cases on analyses of corroded products. Now that is obviously a very insecure foundation. It is like taking a piece of rust, which has been lying around for a while, and analyzing that, and finding perhaps some soot in it, and saying that since the carbonization material was there is was necessarily a cause of the first formation of the rust.

I am not trying to minimize the role of hydrogen cyanide. It is exceedingly important but I think that the mechanism of the reaction should be remembered.

We all know that certain kinds of iron oxide react very readily with cyanogen, and there was, some time ago in the Koppers laboratory, a study made of a holder which was very badly corroded. They found that on the side toward the metal it was mainly iron oxide, and on the side toward the gas it was very largely cyanogen iron compound. Apparently the mechanism was: first, the oxygen in the gas plus the water vapor was causing primary corrosion, and this was being accelerated very greatly by

the cyanogen. So any process or procedure that will enable us to cut down the oxygen in the gas is exceedingly important. I think this study of Dr. Brown in calling attention to that factor is exceedingly valuable, and the use of liquid purification where possible should be given credit for that factor.

Scrubbing, particularly the removal of organic sulphur by scrubbing, and the necessity for more efficient condensation is very important. There is a great deal of tarring material and fine spray carried by a final cooler, and the liquid purification plant helps to knock that down, and it does some cooling. In fact, I think this study was initiated partly by suggestions from Mr. Ramsburg in endeavoring to combine final cooling and purifying processes.

Possibly these vapor pressure studies that have been suggested will show that it is possible to get some effective scrubbing which will assist very greatly in this gum trouble. A good oil scrubbing process may conceivably reduce a certain amount of indene and other unsaturated hydrocarbons, and I think we are coming to a time when it will be necessary for you gas men, if you do not oil-scrub, to consider some form of an oil-scrubbing process. You already have naphthalene troubles that are exceedingly important. You have these gum troubles that are exceedingly important. Possibly some of these odor troubles will be remedied by oil scrubbing of some kind.

I heartily favor condensing and cooling all you possibly can and applying physical chemical concepts to doing that, but beyond that there are a lot of practical questions involved. It is hard to get well water sufficiently cool to reduce these vapor pressures where we want them, or to get wells that have a great enough supply of water. While I agree with Mr. Stone that there is a great deal yet to be done, I believe that we have already done a great deal. The Koppers liquid purification process has been developed, largely by chemists and chemical engineers, and Dr. Brown's study is also a good example of what a research chemist can do to help the gas industry.

I think the gas industry owes a debt of gratitude for that kind of work.

F. W. Sperr (Pittsburgh, Pa.): As to the Denver plant being the only plant for scrubbing water gas, you will find in the paper a list of the plants with those in operation starred. To the starred ones you should add the plants of the Pacific Gas & Electric Company at San Francisco, and of the Denver Gas & Electric Company at Denver. Denver is the first plant that has been put into large scale operation in water gas, but there are several others which will soon be put into operation. I believe the Boston plant will very soon be put into operation on water gas.

Regarding the question of organic sulphur with relation to odor at the Allentown plant, that odor is produced by such extraordinarily minute amounts of material that it is entirely possible for it to produce an odor in the air and still not be detectable at the purifying plant. I am absolutely sure that the odor at the Allentown-Bethlehem plant is not that of hydrogen sulphide. The only trouble is our tests are not sufficiently done. When I say "organic sulphur compounds" perhaps I am limiting it too much. Other organic compounds are still capable of producing the odor.

I got my Bethlehem results from the only records available which showed an efficiency of 91 per cent at maximum

rates. All of the other plants on which I have information, which were designed on the same lines as the Allentown-Bethlehem plant, have shown more than 90 per cent efficiency at the maximum rates. Of course, our efficiencies have been obtained with a solution of 3%, whereas they use very little solution at the Allentown-Bethlehem plant.

We fully appreciate the importance of the odor question and are working very actively on it. Looking back, you will realize that we have accomplished a great deal and we are not going to be beaten by this odor question.

A. R. Powell (Pittsburgh, Pa.): As to Mr. Stone's discussion, the committee has been well aware of the data on corrosion by cyanogen in gas. Last year's report quoted different gas journals, and different authorities in the gas business, on the possible effect cyanogen might have in corrosion.

The effect of other complicating factors, however, has never been fully determined. Perhaps we did not make it sufficiently clear that we desired a scientific investigation which would separate these different factors and determine how much cyanogen would cause corrosion, and if the oxygen were apt to cause corrosion. We have been unable to find a scientific study made along these lines, and we found there was no man on the committee who could give it the necessary time. Much time and effort are required to get that information.

Undoubtedly cyanogen assists in the corrosion, but how much and how small a quantity you have to have before you get no corrosion has absolutely never been determined. Otherwise there would not be this discussion that we see going on in the English gas journals.

In all these tests the fixed sulphur always ran under 30 grains. I do not believe that many plants in the country do consistently run over 30 grains of organic sulphur. We could not, of course, run a test constantly at these plants, but took them more or less at random. Cases where the organic sulphur would run over 30 grains would probably be under conditions such as three years ago when plants were getting any coal or oils that they could regardless of the sulphur content. However, there must be some plants that do run over 30 grains, otherwise there would not have been attempts to develop processes for removal of the carbon bisulphide, some of which are now in operation.

The statement that Mr. Hall made is that one of the advantages of the oil scrubbing in removing the organic sulphur was that light oil could be recovered at the same time. He did not say that this method was the most efficient, but that the removal of the light oil was simply a by-product of the process. If you can get another advantage out of the thing it certainly is worth while. Undoubtedly it is not the most efficient way, but there must be some benzol removed.

There were no tests made on plants using high sulphur coke and oils, but those have been used and it has been definitely established that high organic sulphur results.

Relative to spent oxide removing some of the carbon bisulphide if anything will—I think that we emphasized too much in this report that organic sulphur was removed by any oxide. If you average the figures you will say as a general rule that no organic sulphur is removed by the oxide. Absolutely fresh

oxide perhaps would have some tendency, simply by physical absorption, to remove some carbon bisulphide, and under other conditions you might get a spent oxide to remove some carbon bisulphide.

The main thing is that there is very little change and you cannot consider oxide, either fresh or foul, as worth anything as an organic sulphur remover.

FINAL ADJOURNMENT

APPENDIX

Reports of the following technical committees were not presented at the Convention although progress is being made in their work and their activities will be continued: Committee on The Measurement of Large Volumes of Gas—M. E. Bensch, Chairman, Chicago, Ill.; Holder Committee—H. E. Bates, Chairman, Chicago, Ill.; Committee on Refractory Materials—W. H. Fulweiler, Chairman, Philadelphia, Pa.

The following reports of technical committees, while not presented at the Convention, are here re-published from the A. G. A. Monthly as a matter of record:

REPORT OF THE COMMITTEE ON CAST IRON PIPE STANDARDS

Walton Forstall, *Chairman,* Philadelphia, Pa.

In March, the Committee sent a questionnaire to each of the pipe foundries inquiring about the demand for concentric reducers, offsets and the several varieties of quarter, eighth and sixteenth bends. The replies indicated little or no demand for concentric reducers or offsets and for some of the bends, and the information may prove of value in case any attempt is made to adopt joint standards for gas and water special castings.

The American Engineering Standards Committee has appointed a "Special Committee to Consider Approval and Sponsorship of A. G. A. Specifications for Cast Iron Pipe and Special Castings" and on this, the committee is represented by Walton Forstall.

The committee recommends a slight change in Bells No. 1 and No. 2 in sizes 4″, 6″ and 8″. This change consists in a longer taper where the bell joins the barrel of the pipe and is desirable to reduce foundry losses now experienced from "checked bells." It will mean changes in dimensions on pages 8 and 9 of the "Standard Specifications" as follows:

Dimensions in inches

	L		*F′	
Size	Old	New	Old	New
4″	1.90	3.25	1.09	2.50
6″	2.00	3.25	1.12	2.50
8″	2.10	3.25	1.19	2.50

*F′ replaces external radius F as shown in cuts on pages 8 and 9.

REPORT OF THE COMMITTEE ON WASTE DISPOSAL FROM GAS PLANTS

L. J. Willien, *Chairman,* Boston, Mass.

The committee during the past year acted as an advisory committee and stood ready to assist any member company that was confronted with a problem in waste disposal. The committee was called upon only once during the year for advice. That was in connection with the disposal of waste from a water gas plant. Two members of the committee visited the plant and submitted a report on the situation which included definite recommendations.

Tar Emulsions

The problem of dehydrating tar emulsions was put up to the Chemical Committee which passed it on to the Waste Disposal Committee. The following is all the data which the committee collected:

The formation of tar emulsions, especially water gas tar emulsions, can usually be traced to the operating conditions existing around the plant. In the appendix of this report will be found some recommendations in regard to the care and operation of the different pieces of apparatus in a gas plant which have to do with the removal of tar from the gas which will reduce the formation of tar emulsions to a minimum. These recommendations were submitted by a holding company which experienced considerable trouble, especially during the war, with the formation of tar emulsions in the gas plants under their management. These recommendations were drawn up and sent out to the gas plants as instructions. By carefully following these instructions the formation of tar emulsions has been practically eliminated.

The relief holder tank is usually used as a "dumping ground" for all tar and liquors produced around the plant. The movement of the holder causes a churning of the liquid in the tanks and tends to keep the tar in the form of an emulsion. After a few years the holder tank becomes full of tar emulsion, which runs off through the overflow pipe. The gas company then realizes that they have a problem on their hands. The tar in the form of an emulsion instead of being an asset is a liability. No tar refinery will buy it or even accept it as a gift. As a fuel it is worthless because it will not burn, and it is not permissible to run it into a sewer or stream.

The following are a few methods which have been used for the dehydration of tar emulsions:

(1) Spray method: This consists in heating the tar to about 150° to 160° F, then pumping it into a large settling tank through an ordinary spray nozzle at a pressure of from 80 to 100 pounds per sq. in. After being sprayed into the settling tank, the tar is allowed to settle, keeping the temperature at about 150° to 160° F. The spraying seems to break

up the emulsion, which separates in the settling tank.

The New England Gas & Coke Co. at Everett, Mass., has used the spray method successfully with coke oven tar (in fact they developed it) reducing the water content from around 4% to 5% or less.

It is doubtful if the spray method will work so well with water gas tar emulsions. Some tests were made at the Malden & Melrose Gas Light Co., Malden, Mass., using a water gas tar emulsion containing 50% water. Two types of sprays were used, a nebulizing spray, and a Spray Engineering Co. spray. The former clogged up with carbon, the latter did not. The results of the tests showed that only about 10% to 12% of original emulsion was recovered as tar containing less than 5% water. The balance remained in the form of an emulsion which required further treatment.

(2) Expansion or vaporization method: A very complete description of this method will be found in an article by A. W. Warner in the A. G. A. Monthly for July, 1922, Page 437. Mr. Warner is using this method for dehydrating coal tar made in horizontal retorts. He has not tried it with water gas tar, but it seems reasonable to suppose that it will work equally as well as with coal tar. The secret of the process depends upon starting with some water free tar then adding a small amount of the emulsion before heating. Mr. Warner stated that apparatus at Chester, Pa., handles 300 gallons of emulsion an hour without any trouble.

(3) Agitation method: The emulsion is placed in a tubular condenser (around the tubes) and heated slowly, passing exhaust steam through the tubes.

The tar is agitated slightly by means of air. When the temperature reaches 180° to 190° F. the air and steam are shut off, and the tar allowed to settle for 48 hours. The tar and water separate and the tar is drawn off the bottom.

(4) Sharples centrifugal method: This has been discussed in the committee's reports of 1920 and 1921.

This is all the data which the committee was able to collect on dehydrating tar emulsions. It realizes that it is an important problem and recommends that next year's committee continue the work with the view to finding a cheap and efficient method of dehydrating an emulsion of either coal tar or water gas tar.

APPENDIX

Recovery, Storage, Sampling and Shipping of Tar

Tar is a valuable residual from the production of both coal and water gas. In order to obtain full credit from this by-product, it is necessary that the production, storage, sampling, and shipping of the tar be followed closely.

Coal Tar

Coal tar should be removed from the hydraulic main either by a continuous overflow or a displacement system. If a displacement system is used the tar should be drawn off at regular intervals, depending upon the capacity of the displacement tank. In order to obtain the best quality of tar at this point, it is necessary to circulate weak liquor in the hydraulic main. If cold water is used there will be a tendency to chill the gases too suddenly, to weaken the liquor that is later used for concentrating purposes and to cause the tar to become heavy, making it troublesome to remove.

Overflows from the hydraulic main, primary condenser, P. & A. Tar Extractor, secondary condensers and scrubbers, in fact from every piece of apparatus used for cooling and handling the gases, must go to one storage well where the liquor will separate from the tar, the tar going to the bottom and the liquor overflowing to the weak liquor well. With all drains running to one tar well and with but one overflow from this tar well to a weak liquor well, there is little likelihood of any tar being lost. Any tar that might overflow into the weak liquor well can be periodically reclaimed from the bottom of the weak liquor well and pumped back to the tar well. By having the tar well properly gauged, tar stocks can be followed up closely and the amount made per month and the gallons made per ton of coal carbonized, carefully checked.

The temperature of the gas should be gradually lowered from the time it leaves the hydraulic main until it gets to the P. & A. tar extractor, which it should reach at about 100° to 110° F. Sudden drops in temperature at any particular point should be avoided. From the P. & A. tar extractor through the secondary condensers and scrubbers, the temperature should be gradually lowered to not less than 80° at the inlet to the purifier. Temperature at inlet to purifier should range between 80° and 90° F. Under these conditions all the tar should be removed from the gas before the gas reaches the purifiers.

The tar well should be of sufficient capacity to enable tank car shipments to be made without taking all the tar in the well as tar at the bottom of the storage well always contains less water and moisture than tar that is near to the dividing line between the tar and the weak liquor. At the smallest works, tar storage well should be of at least 20,000 gallons capacity. The tar well should be covered with a tight non-inflammable roofing in order to prevent the escape of gases from the ammoniacal liquor. The well should be so constructed that no dirt or water can get into it either from seepage or from surface drainage and should have but one overflow, that running to the weak liquor well.

Water Gas Tar

It is more difficult to procure and account for all the tar made from water gas than from coal gas, consequently manufacturing processes, separation and storage require more attention. Temperatures carried in the superheater while making gas have a direct bearing on the kind of tar that will be made. If the temperatures are too high, lampblack will result which will combine with the tar and cause an emulsion of water and tar. It is practically impossible to separate such tar and water by ordinary gravity separators. It necessarily follows that the heat in the superheater should be such that no lampblack is made. If temperatures are too low the oil will not be completely cracked and an excessive amount of oil will appear in the seal pot at the outlet of the wash box as well as on the surface of the water in the tar separator. The next step is the use of hot water (by circulating from the tar separator) in the washbox. Cold water should never be used as it not only tends to cool the hot gases too suddenly, thereby losing some of the valuable gas vapors by condensing them back to oil, but also tends to form an emulsion of the water and tar. The overflow from the wash box should be run to a properly designed separator.

If it is found necessary to use water

in the scrubber at the outlet of the water gas set, hot water from the tar separator should be used. Never use cold water as this shocks the gas too suddenly at this point and tends to throw down some of the valuable hydrocarbons as well as heavy tar which will soon clog up the scrubber trays. With average relief holder capacity and sufficient scrubbing and condensing equipment between the relief holder and the purifiers, the use of water in the scrubber at the outlet of the water gas is seldom necessary and should be avoided if possible.

From the scrubber the gas goes to the relief holder where more tar will be deposited and being heavier than the water will settle to the bottom of the tank or pit. This tar should never be left in the holder pit or tank but removed periodically and run through the separator from where it can be pumped to storage. Tar handled in this manner will be low in moisture and will eliminate the making of emulsion in the relief holder due to the churning action which takes place by the rising and falling of the relief holder while making gas into and drawing gas from the relief holder at the same time.

With ample and properly designed condensing and scrubbing apparatus, all of the tar should be removed before the gas reaches the first purifier. There should be a gradual drop of temperature from the outlet of the washbox to the inlet of the first purifier. The temperature at the inlet of the first purifier should never be below 80° F. and preferably between 80° and 90° F.

Overflows from the various pieces of apparatus and all water and tar from drips should be run to the separator. Where both coal gas and water gas are made, care should be taken to keep the tars separate, otherwise emulsion will result, especially if the overflows from the scrubbers and condensers are run to one common separator.

Under ordinary operating conditions where nothing enters the separator other than the overflow from the different pieces of water gas apparatus and drips, there should never be any overflow to the sewer from the separator, in fact, in the warmer months due to evaporation, it may be necessary to use some make-up water. The tar in the separator should never be left to accumulate in the separator to any great amount as this will retard the flow of the tar and water through the different sections and prevent the best separation of the water and tar.

Storage

Tar wells or storage tanks of ample storage capacity should be provided. Even more precautions are required when shipping water gas tar than with coal tar as moisture and water do not as readily separate from water gas tar. Deep tanks are an advantage as the pressure of water and tar tends to force the water from the tar at the bottom of the tank, leaving it nearly moisture free. Tar storage tanks even in the smallest works should be of at least 20,000 gallons capacity so that there will always be at least one tank car of good, moisture-free tar in the storage tank. Storage tanks should be constructed so that no water or dirt can get into them either through seepage or from surface drainage.

The Steere Engineering Company has patented a small device called a "tar camera" which, if intelligently used, will show the comparative amount of tar being taken out by different pieces of

apparatus. This camera is especially useful at the inlet to the purifiers where but a trace of tar should be observed as an indication of perfect condensing and scrubbing.

Loading Tar For Shipment

Tank cars in which shipment is to be made should be inspected before being filled to make sure that they are tight and do not contain any foreign substance or water. Tank cars loaded with tar should be allowed to stand twelve hours after loading, before being shipped out and before shipment should be carefully inspected for free water on the top. Any free water that has accumulated should be removed. Tank cars should be filled full and two or three inches into the dome.

REPORT OF THE COMMITTEE ON PROGRAM OF RESEARCH

DR. J. F. WING, *Chairman*, Boston, Mass.

THE COMMITTEE has inquired of all gas associations and some public service commissions about any arrangements that have been made for co-operative research with educational institutions, and has elicted the following information:

California Gas Research Council, H. L. Masser, Chairman, Pacific Finance Building, San Francisco.

This newly formed council has not yet completed its program. Meetings are to be held in January, June and September. Mr. W. M. Berry has been chosen as Executive Engineer. They plan to carry out researches on the problems peculiar to their conditions in the plant of the utility best fitted to each one.

Pacific Coast Gas Association, W. M. Henderson, Pacific Gas & Electric Company, San Francisco, Secretary.

The association has no co-operation for research with universities but makes efforts to interest students in the business. They plan to have lectures on the gas industry at the universities. They are themselves investigating standards for construction, operating and all technical matters peculiar to their district.

New England Industry Gas Salesmen, Educational Committee, J. J. Quinn, Citizens Gas Co., Quincy, Mass., Secretary.

They have no research but an educational program. An elaborate and profitable course has been given at the Massachusetts Institute of Technology by professors and gas experts during the last two years, and is continuing.

Iowa District Gas Association, H. R. Sterrett, Des Moines, Secretary.

They expect to make arrangements with the Iowa State College for testing refractory. No researches are progressing now. The Iowa State College has joined in giving educational courses.

Wisconsin Utilities Association, J. M Cadby, Madison, Secretary.

They maintain a fellowship at the University of Wisconsin. One-half of the fellow's time is applied on gas research. The association calls on university men for special technical work, which is compensated. The present subject of research is understood to be Naphthalene Removal.

Michigan Gas Association, A. G. Schroeder, Grand Rapids, Secretary.

They maintain a fellowship at the University of Michigan. Now studying Carbonization of coal under certain conditions.

Pennsylvania Gas Association, J. B. Klumpp, Chairman Committee on Education, Philadelphia.

They have no co-operation for research with universities but individuals in the gas industry have arranged for educational lectures.

New England Association of Gas Engineers, J. L. Tudbury, Salem, Secretary.

Have no arrangement for co-operative research but have arranged with Massachusetts Institute of Technology for a general course on gas engineering.

Empire State Gas & Electric Association, C. H. B. Chapin, Grand Central Terminal, New York, Secretary.

Has arranged no co-operation with universities. Not aware that any company has.

Illinois Gas Association, R. V. Prather, Secretary.

Through a committee of the association, the University of Illinois has established a course on gas engineering. The association maintains two research graduate assistantships in gas engineering in the university.

Indiana Gas Association, E. J. Burke, Secretary, Indianapolis.

Have no co-operative arrangement with universities on research. The Indiana Utilities Association is doing educational work with educational institutions.

South Central Gas Association, S. B. Ballinger, Secretary, San Antonio.

Has arranged nothing yet but is interested in the matter.

Eastern States Gas Conference, L. R. Dutton, Secretary, Jenkintown, Pa.

Have started no activities of this character.

The Johns Hopkins University announces courses in gas engineering, supported by gas industries in many states through the agency of the Southern Gas Association. The university will utilize their research facilities and the manufacturing plants in their vicinity.

The two research subjects in progress, noted above, Naphthalene and Carbonization, are not abstruse and theoretical only, but eminently practical and of industrial importance.

At present practically nothing is known about research which these institutions have inaugurated voluntarily and independently. Possibly there is at present duplication. There were forty-eight institutions equipped for research in some of the ramifications of the technical question. These have been listed by the American Gas Association.

The work of the committee so far has been to obtain a view of the working field. No other matters have been referred to the committee.

Since this report was printed, the following information has been received:

In reply to a letter of inquiry sent to various educational institutions, to learn if they are conducting researches on matters of importance or interest to the gas industry, the committee has received twenty-two replies.

Eleven of these correspondents indicate that they have in the past carried on researches or are doing so at the present, or that they are willing to carry on such researches. These are listed below, with brief remarks concerning each, which are derived from the letters. Six of them mention subjects which are now under investigation. It is certain others not reporting are active on subjects of the same nature.

Calif. Institute of Technology
Pasadena, Calif.
Prof. R. A. Millekan

Researches on mobility of irons in gas flames.
Detonation of gas in engines.
On separation of constituents of natural gas by charcoal.
None are completed.

University of Denver
Denver, Colorado
Prof. W. D. Engle

No researches in progress. Earlier made a confidential research of gas from lignite.

University of Illinois
Urbana
Prof. S. W. Parr

Researches on: Low temperature carbonization.
Distribution of sulphur in coal beds of Illinois.
Determining softening and solidifying points of coal.
Theory of carbonization.
Solvents for constituents of coal.
"Mother" of coal, with reference to sulphur content and to its effect on carbonization.
Exact methods for analysis of fuel gas.

They wish to have a report on researches brought up to date. In the university there are two men who hold gas research scholarships. They have good facilities for such work.

University of Michigan
Ann Arbor
Prof. A. H. White

Researches on destructive distillation of crushed or powdered coal by continuous carbonization and studying the effects of time and surface contact on the product.
Utilization of lignite.
Thermal conductivity of refractories.
Errors in determining of heating value of fuels by bomb calorimeters.
Theory of decomposition of petroleum.
They have good facilities.

University of Nevada
Reno
F. H. Sibley, Dean

No researches in progress, but would cooperate.

College of the City of N. Y.
New York
Prof. H. R. Moody

No researches but would like subjects suggested for research.

Columbia University
New York
Prof. J. J. Morgan

Researches on tar acids, especially low temperature tars, including recovery from coal tars.
On water gas tar emulsions.
Utilization of low temperature tars.

It needs a scholarship of $1,500, plus $1000 for expense of research on coal carbonization. They have good facilities.

University of Cincinnati
Prof. R. S. Tour

No researches in progress. Have earlier made pertinent researches.

Case School of Applied Science
Cleveland, Ohio
C. S. Howe, Pres.

No researches. Is willing to undertake them.

Ohio State University
Columbus, Ohio
Prof. D. J. Demorest

Researches on availability of Ohio coals for gas making.
On dry cleaning of gas coals.
They have vertical retort plant.

Penn. State College
State College, Pa.
Prof. H. G. Hechler

No researches. Is willing to undertake problems of fundamental nature.

On regarding the shortness of the list of those institutions concerning whose activities we have information, it is evident that the gas industry is not utilizing the technical and scientific agencies now existing, as these agencies should be asked to serve.

It is quite probable that they have not been approached, but more probable that they lack funds which may be devoted to the expense of special research. This last factor must be trifling compared with the expense of the investigations and experiments which certainly are being carried on privately by all progressive companies, some of which being profitable and some futile.

Letters received from a few of the larger gas companies show that they are carrying on special investigations.

The larger California companies have formed the "California Gas Council" under the supervision of the State Railroad Commission and have been for two years studying all aspects of the manufacture and distribution of oil gas. These results will be published soon, and the work continued.

The Laclede Gas Light Company, St. Louis, has been studying Elkhorn coal in the different seams; also the effect of its weathering on the production of gas and coke and other by-products. It is also developing a laboratory method for testing coals.

The Tacoma Gas & Fuel Company is investigating the rise of bituminous coal in water gas manufacture. There are also rumors of the activities of other companies.

We know that the information so far obtained as to the status of research work in the industry is incomplete.

As the information is obtained, the committee on Program of Research proposes to utilize it for two objects:

To forward to all research agencies a re-capitulation of the research affecting the gas industry in progress throughout the country so that all may be advised as to what is being done and eventually a co-ordination of all such research accomplished.

To make the Committee on Program of Research a clearing house through which all agencies interested in gas research will report progress of their work to the end that any proposed research may have the consideration of the A. G. A. committee from the standpoint of what is already being done.

AUTHORS